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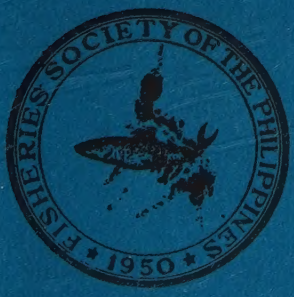
BULLETIN

OF THE

FISHERIES SOCIETY

OF THE

PHILIPPINES



MANILA

VOLUME 1, 1950 COMMEMORATIVE ISSUE

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FISHERIES SOCIETY

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PHILIPPINES

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BULLETIN
OF THE
FISHERIES SOCIETY OF THE PHILIPPINES

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FISHERIES SOCIETY OF THE PHILIPPINES

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BULLETIN OF THE
VOL. I FISHERIES SOCIETY OF THE PHILIPPINES 1950

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AIMS

of the

FISHERIES SOCIETY OF THE PHILIPPINES

●

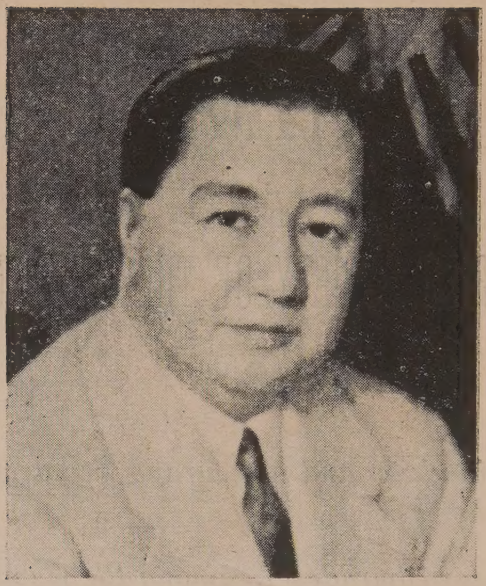
To stimulate and encourage research in fisheries.

To foster comradeship among the members, promote collaborative research in fisheries and coordinate these with the economic needs of the nation.

To cooperate with the government of the Philippines in the execution of fishery laws and in the formulation of policies dealing with the conservation and development of fisheries.

To gather and disseminate technical and other information pertaining to fisheries.

To engage in any activity in the furtherance of the objects and purposes set forth.

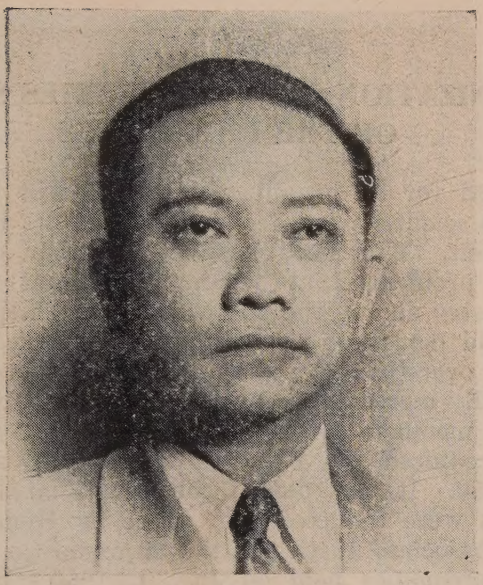


MESSAGE

Philippine waters richly abound in fish. Properly conserved and scientifically cultured and distributed, our fish-products will not only be enough for local needs but will leave us plenty for export.

I am glad to learn that the Fisheries Society of the Philippines has been organized principally for the purpose of stimulating research in fisheries, promoting the spirit of cooperative undertaking among fisheries scientists, and coordinating its activities with the economic development plan of the country. This is a laudable program. I hope it can be expeditiously carried out for the benefit of our country and people.

ELPIDIO QUIRINO
President of the Republic of the Philippines



MESSAGE

In greeting the officers and members of the Fisheries Society of the Philippines, I am also extending to them my gratitude for pooling in their share of the efforts in the implementation of our present all-out campaign for food production.

The exploitation of our aquatic resources is as much the concern of our fishery technologists as the men who live on the fishing industry alone; as the latter must catch fish to earn a living, so must the former take the appropriate steps to keep that source of supply and livelihood steady and sufficient.

Our fishing grounds are not overly rich as many suppose. For this reason we have to take good care of the little that we have. For any source of supply, no matter how abundant, can dwindle away in the long run if the methods of consumption are not well-supervised. This is where our fisheries researchers and technologists come in. With their training, they can serve as able guardians of the aquatic wealth of the Philippines.

To the Fisheries Society of the Philippines, therefore, goes my sincerest wishes for a successful endeavor. May the concerted efforts of its members towards the coordination of the economic development of our Republic be crowned with success in the near future.

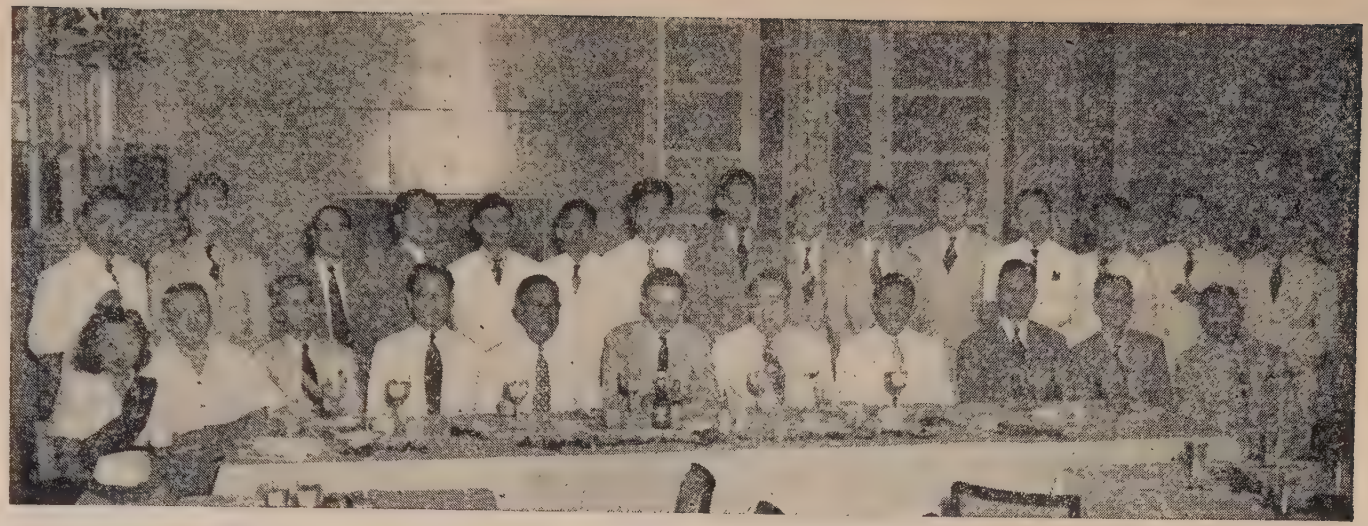
FERNANDO LOPEZ
Vice President
and concurrently Secretary of Agriculture
and Natural Resources

ORGANIZATION OF THE FISHERIES SOCIETY OF THE PHILIPPINES

The need for an organization which will bring together the fisheries scientists and technologists of the Philippines has long been felt. This need has been further emphasized by the serious problems that began to confront the Philippine fishing industry during the post-war years, chief among which are the rapid depletion of the fishing grounds due to illegal fishing and over-fishing and the need for more protein food for the rapidly increasing population. In view of this urgency the ranking members of the technical staff of the Bureau of Fisheries organized the Fisheries Society of the Philippines in June, 1950. It was duly incorporated on June 26, 1950. The officers were inducted into office by Honorable Alexander Reyes, Associate Justice of the Supreme Court, during the inaugural ceremonies held on July 1, 1950. Dr. William J. Ellis, Principal Scientific Officer of the UNESCO East Asia Science Cooperation Office was guest speaker at the occasion and delivered an inspiring talk on the furtherance of fisheries research in this part of the globe. Director of Fisheries D. V. Villadolid, as Chairman of the Society, delivered the inaugural address during which he called upon research workers throughout the land to dedicate their interests, training, and aptitude for research work in the various fields of fisheries.

In a meeting held by the charter members of the Society on June 6, 1950, the following officers were elected: Dr. D. V. Villadolid, chairman; Heraclio R. Montalban, vice-chairman; and Mariano A. Abagon, secretary-treasurer. The research program of the Society was divided into specialist groups headed by Claro Martin as Chairman of the Committee on Technology and Socio-Economics and Domiciano K. Villaluz as Chairman of the Committee on Biology and Hydrology. The other charter members of the Society are: Jose R. Montilla, Jose G. Sanchez, Guillermo J. Blanco, Gonzalo G. Ferrer, Jose I. Sulit, Santos B. Rasalan, Herminio R. Rabanal, Porfirio R. Manacop, Daniel M. Buñag, Antonio M. de Vera, Virgilio A. Uyenco, Alfonso R. Sebastian and Augusto D. Manalo.

A set of rules has been adopted by the organizers to extend membership in the Society to technical men in other institutions who may be engaged in researches on fisheries or related subjects.



Members of the Fisheries Society of the Philippines present during the inaugural luncheon meeting at the Aristocrat on July 1, 1950. *Seated, left to right: Carmen D. Velasco, stenographer-recorder; Herbert E. Warfel; Jose R. Montilla; Claro Martin; Heraclio R. Montalban; William J. Ellis, guest speaker; D. V. Villadolid; Daniel M. Buñag; Domiciano K. Villaluz; Mariano A. Abagon; Porfirio R. Manacop. Standing, same order: Gonzalo G. Ferrer; Pedro A. Acosta; Antonio M. de Vera; Inocencio A. Ronquillo; Guillermo J. Blanco; Herminio R. Rabanal; Augusto D. Manalo; Ricardo S. Esguerra; Jose G. Sanchez; Alfonso R. Sebastian; Virgilio A. Uyenco; Jose I. Sulit; Bienvenido Y. Datingaling; Santos B. Rasalan; Enrique Salafranca.*

TALK DELIVERED DURING THE INAUGURAL MEETING OF THE FISHERIES SOCIETY OF THE PHILIPPINES ON JULY 1, 1950

D. V. VILLADOLID
Chairman, Fisheries Society of the Philippines

I am inspired on this occasion to speak before you because of the presence in our midst of two distinguished guests: Dr. William J. Ellis and Justice Alexander Reyes. One is a scientist, being the principal officer of UNESCO in its East Asia Science Cooperation Office, and the other is a jurist and associate justice of the Supreme Court of this country. Few would be able to find similarity in a scientist and a jurist except in their eternal search for truth, but they have been especially invited to honor this occasion, the inauguration of the Fisheries Society of the Philippines, because of their common interest in the fishing industry. Dr. Ellis, being a scientist, could be forgiven for being fish-minded, but Justice Reyes, who is deeply engaged in resolving human conflicts, is one of the few Filipinos whose interest in the fishing industry of our nation is still unsurpassed. We celebrate today the birth of our Society with these two distinguished guests that we may

be inspired by their presence and patronage. It is in the spirit of humility that we, organizers of the Fisheries Society of the Philippines, wish to usher in our fisheries fraternity so that from its humble beginning it may gradually develop into full usefulness to the nation as it achieves maturity. Let us remember from now on this inspiring moment, and from here carry on with its noble purpose.

The leaders of our country have now realized the importance of the sea as a source of food for our rapidly increasing millions of people. This realization is demonstrated by the creation of a full-fledged Bureau from a mere Division of Fisheries and the assignment to it of the full management and administration of the aquatic resources of the nation.

The fishing industry was already a significant occupation of the nation before the outbreak of the second World War. Let us now examine how much our people and our leaders have become even more fish-conscious during the years that have followed. Nearly two hundred thousand Filipinos were directly engaged in the fishing industry in 1938. In 1949, however, this industry provided occupation for almost half a million people. Before the war there were only 283 licensed fishing vessels of more than 3 tons gross, the operations of which were mostly controlled by aliens, but in 1949 the number of fishing boats of this category had increased to 826. Almost all of these boats are now owned and operated by Philippine citizens. Whereas the catch of these licensed fishing vessels was only 170,000,000 kilograms of fish in 1939, the catch record for 1949 was 238,000,000 kilograms. In 1939 there were 61,000 hectares of bañgos fishpond; in 1950 there were more than 70,000 hectares in operation. Our records today show that by 1952 the area of productive bañgos fishponds may reach a total of 100,000 hectares. The bañgos harvest alone, as a result of this rapid expansion, increased from 21,000,000 kilograms in 1941 to 25,000,000 kilograms in 1949. Before the war the nation's fishery resources was entrusted to a mere Division of Fisheries of the Department of Agriculture and Commerce, with an appropriation of ₱226,000 annually. Today this important resource is managed by a full-fledged Bureau of Fisheries with an appropriation of ₱1,178,140.00. In 1940 the income of the Division of Fisheries was about ₱56,000 but in 1949 the revenues collected by the Bureau of Fisheries was no less than ₱230,000.00.

From the foregoing comparison between the pre-war and the post-war years, it is obvious that there has been a tremendous expansion in the fishing industry which was significantly marked by the long-overdue expansion of the branch of the government which serves as the trustee of the nation's aquatic

resources. Against this inspiring picture of progress in the fishing industry, however, the Bureau of Fisheries soon became confronted with the problems of fisheries conservation. For among our fishermen who believe in the richness of our seas, are evil men whose lust for gold has made them forget their public spirit and sense of decency. Today, this rising tide of criminality threatens to destroy what we have built from the ruins of the post-war years. The Bureau of Fisheries is deeply engaged in fighting this criminal assault on the aquatic patrimony of the nation. As a newly organized Bureau, it has been unable to stop illegal fishing and has consequently been the target of much public criticisms. But now in its fourth year of service, I feel proud as its first director through all these trying years of its formative life, to announce that the tide is now gradually turning against the vandals of our seas. In this, one of the most important missions of the Bureau, it can now show that it has kept faith with the people's trust. It has not completely stopped illegal fishing as yet, but it has reduced the danger to our aquatic patrimony considerably. The Bureau of Fisheries notes with satisfaction that now, more than ever, the number of arrests and actual convictions by the courts throughout the land of violators of our fisheries laws has increased so much as to serve as real deterrence to others. These criminals have enjoyed a long holiday, mostly because of a technicality in our penal law which requires apprehension *in flagrante delicto* for a successful conviction. Since much of the illegal fishing is made in isolated places or in darkness, to catch such criminals red-handed is almost impossible. The Bureau of Fisheries in its determination to improve its position in the enforcement of the fishery laws of the country, has conducted studies on the effect of explosives on the internal structure of the fish. The results obtained are so far-reaching that it is now possible to definitely distinguish a dynamited fish from a normally caught fish. On the basis of this study the Bureau of Fisheries recommended a law, recently passed, which makes laboratory tests proving death by dynamite *prima facie* evidence of guilt. The Bureau of Fisheries has of late secured convictions in court in illegal fishing cases on evidence based on this study.

This is the type of strength that the Bureau of Fisheries is gradually building up to further increase its effectiveness in helping to produce more food for the country.

But the Bureau of Fisheries does not feel honored by being recognized as a successful policeman. The Bureau has been preaching conservation fully aware that no amount of physical surveillance and apprehension can control illegal fishing without the sympathy, understanding and cooperation of

the citizens of the country. The policeman cannot always be where crime is being committed. We can only stop destructive fishing by developing a mentality in our own people which will react with horror at the thought of using dynamite or poison. The heartless vandals must be won, and won completely, to prevent them from spawning their kind. The non-fishing elements of our population must be so educated that they will react positively and immediately at the sight of crimes against our aquatic resources in the same degree as they would react to any criminal assault on their own property or the property of their kin.

This type of national discipline can be only developed, slowly but surely, by an educational campaign. The Bureau of Fisheries has already gone far in the application of this method of approach to the pernicious problems of destructive exploitation. Through its recommendation, His Excellency, the President of the Philippines, has proclaimed the last Saturday of October of each year as Fish Conservation Day. Pamphlets, posters and leaflets all dealing on fisheries and fish conservation are on this day of dedication distributed throughout the Philippines through the schools, the provincial and municipal governments, service clubs and business concerns. Teachers in all schools, institutes, and colleges are asked to give lectures on the subject to their respective classes. Educational displays and demonstrations are given by the Bureau of Fisheries through all its extension services in the field.

In the execution of this educational campaign, the Bureau of Fisheries has further improved its position with the generous cooperation from our leaders in the government. With this support it has established the Philippine Institute of Fisheries Technology in Manila and a fisheries school in Catbalogan, Samar. With more funds, it hopes to open other regional fisheries schools throughout the Philippines. In these schools, the young people are taught the latest methods in fish capture, fish culture, fish preservation and processing of fisheries products. The Institute of Fisheries Technology in Manila, now in its fifth year, has turned out a total of 124 graduates trained in the arts and sciences of the fisheries and through its initiative, 125 trainees in fisheries from among the students and personnel of the Bureau of Fisheries were sent to the United States for training under the auspices and expense of the benevolent and generous American Government and people. Already, the fishing industry has absorbed a good number of these graduates. Their performance in the industry belies the contention of criminal fishermen that a fisherman operates at a loss when using nets instead of dynamites.

The extension service of the Bureau brings to all parts of the Philippines the most modern methods of fish capture and culture and processing of fisheries products. It now has four training and demonstration vessels which are being sent to any part of the Philippines where demonstrations on the various aspects of the fishing industry are requested.

These, in brief, are some of the activities of the Bureau of Fisheries with which it hopes to win the mind and heart of the people away from destructive fishing. Still we find supposedly irrefutable arguments among those who advocate fishing by dynamite or poison. In truth, there is still much to learn about our fishery resources, many experiments to be made in methods of legal fishing, and a lot of study needed in the more effective utilization of the products of our waters. Science must come in and help this industry. *Here at last is where the Fisheries Society of the Philippines comes in.* Organized for the purpose of stimulating research in the various aspects of fisheries, the members of this Society have many opportunities for service to the country.

We who are gathered here to witness the organization of the Philippines' fisheries scientists into an effective body are challenged by the precarious position of the Republic in the light of developments within and abroad. We are challenged to show illegal fishing operators the way to a legitimate but effective way of securing harvests from seas. We are challenged to find ways to increase food production from our waters and help secure for our people the way to a more abundant life. We are challenged in these fateful days when the nations of the world are trembling at the prospect of another global war, to do our duty and prepare for such an eventuality. We all know that wars are not won by bullets and soldiers alone; there must be food, both for the fighting man and the civilian at home. The fishing industry as one of the major instruments for producing food must be mobilized for emergency. It is indeed fateful that the Fisheries Society of the Philippines should be born under the threatening shadows of these war clouds. Its inauguration today augurs a hopeful future for all its members to serve well our country and its people.

One of the purposes of the Society is to organize Philippine fisheries students and workers into a cohesive group and develop among the members a *cooperative spirit.* In spite of our progress along all lines, we have yet to eliminate the individualistic spirit among the majority of our people. In the conduct of our daily affairs we have seen how this attitude has become our greatest handicap. This attitude for instance is

commonly ascribed to as the main reason why Filipinos fail to assert supremacy in business in their own land. The same attitude can do much harm to the progress of scientific inquiry in our country. With the fervent hope of untying the knot of aloofness and individualism among our scientific talents in fisheries, the Society hopes to overcome this first and greatest disadvantage, and succeeding, we can all look forward to the time when the tremendous energy of the different members can be applied to the task of helping the government in its work of development, utilization and conservation of our aquatic resources.

I thank you.

TALK TO THE FISHERIES SOCIETY OF THE PHILIPPINES AT ITS INAUGURATION ON JULY 1, 1950

W. J. ELLIS
Principal Scientific Officer
UNESCO East Asia Science Cooperation Office, Manila

Mr. Chairman, Ladies and Gentlemen:

I greatly appreciate the honor you have shown me in inviting me to this luncheon for the inauguration of your Fisheries Society. To me, the formation of this society indicates clearly the need you have felt to consolidate your scientific and technical workers in the field of fisheries research and technology and to concentrate your efforts to expand the fishing industry. Personally, I can not endorse too strongly any move which pledges itself to furthering the interests of science and expanding its frontiers.

We in the Natural Science Division of UNESCO who are charged with the extension of scientific knowledge in the underdeveloped countries see the great need of science in increasing food supplies and in raising health and general living standards.

This is expressed by the foresight of your scientific men in inaugurating such a body as this Society to act as a common meeting ground for your own technicians and for those outsiders who may come to your country for consultation and to give advice in the technical assistance program. May I therefore, on behalf of UNESCO, wish you every success for the future of your Society and may its importance and influence in the development of the fishing industry in your country grow with the years.

I can not of course speak with any authoritative knowledge in the field of fisheries and moreover, I would be diffident in speaking at length or in detail to a group of experts like I have before me here. However, I attended the Indo-Pacific Fisheries Councel Meeting in Singapore last year and have also had a good deal of contact with my colleague Dr. Kesteven who is the Executive Secretary of the Council in Bangkok and I have also had a good deal to do with members of your Bureau of Fisheries here in Manila so that I have, due to circumstances, picked up a smattering of knowledge of some of the problems with which the fishing industry is faced. And from this, I am convinced that the industry can be assisted by the application of new and improved techniques.

During the past 10 years, the world population has increased by something like 200,000,000 persons. This increase may be more easily appreciated if I tell you that since we gathered here today there are approximately 2,500 more people in the world. To cope with this ever-increasing population, it is of course necessary to do all we can to improve and increase world food production. And today, no group of people can justifiably neglect to work an industry by any other than the most efficient means at their disposal. If any one group is endowed with an area in which fish abound it is obligatory for them to see that this area becomes a real food producer for those areas less fortunate.

There are of course great limitations in many areas of Philippine waters with regard to increasing the fish catch, not the least of these being the extraordinarily deep waters which surround your country, so that nutrient materials are in short supply in those strata of the sea where fish normally feed. This problem reminds me of the experiments which I saw carried out in the North of Scotland during the war by a research worker named Gross who was working in the Zoology department of the University of Edinburgh. This research worker had carried out a good deal of laboratory research in increasing plankton production by means of the addition of nutrient elements to the water. After a series of laboratory experiments, it was found that a commercial fertilizer with the addition of

sodium nitrate would bring about an increased plankton growth. Large scale experiments were then carried out along these lines in one of the locks to the northwest of Glasgow and it was found that after some period the plankton was so increased that there was a marked increase in the fish production also. I was extremely interested in these experiments but have not lately followed the work which may have been done since this time. However, this indicates the possibility of increasing fish production by artificial means and it is not too far outside the realms of possibility that increased fish production might be brought about by the use of techniques such as this. A little more ambitious scheme was proposed to me at one time by Mr. Warfel whom most of you know from his days with the U.S. Fish and Wildlife Service here. He pointed out that in the future, if atomic power becomes available at economic rates it may be possible to pump large bodies of water from the sea bed to the surface and so bring up the important nutrient materials to the very strata where the nutrients are required for fish growth.

I would also now like to refer to the experiment which was started here by Miss Anderson who was nutritionist with UNICEF and Dr. Leverton, a Fulbright professor of the Philippine Women's University. They initiated experiments to compare the relative merits of feeding milk and the little fish known here as *dilis* to small children and to determine whether the calcium obtained from the *dilis* was as assimilable for the laying down of bone and tooth tissue in the growing child as that contained in milk. The practical aspects of this experiment were only concluded recently but I understand that preliminary observations have shown that children can derive and assimilate sufficient calcium from the consumption of a small amount of this small fish per day. Work such as this is of extreme importance from the aspects of nutrition and it serves to demonstrate the contribution which the fishing industry can make towards the development of the youth of the nation.

One other thing which I envisioned is the question of setting up a canning industry in this country. However, now with the import control and exchange control, it may be possible for you to build up a fish canning industry and thus build up an export trade to assist the economic development of your country.

I am afraid I have spoken in generalities but as I said before, I do not want to go into great detail. There is just one final word that I would like to offer about training in the field of fisheries. I believe that in the past 4 to 5 years, the U.S. Government has done a good deal to assist the industry in your country and it has trained personnel abroad and at home but

this training program must continue since more and more technicians will be required to contribute to the national economy and welfare of the nation.

With the expanded Technical Assistance Program which we hope will come into operation before the end of this year, it may be possible to send people to study abroad in the field of fisheries. My only advice here is that only the most vigorously minded students who are available to you should proceed abroad and they should, as far as possbile, study some specific problem while they are away and on their return be given sufficient facilities and incentive to continue the work which they have begun. Your young workers will have to face hard work and will have to be content to travel to remote parts of the country and become involved in hard manual work for it is impossible for a scientist or technician to practice his profession and keep his collar on and sit behind a desk. Workers in the field of fisheries research and development like any other scientific workers will have to receive adequate remuneration for their labor, for, it will not be possible for any branch to attract young men to develop an industry such as yours without sufficient incentive for them to do so. I do not wish to go on any further as I have in the past heard too many cruel remarks about after-dinner speakers who went too long.

In conclusion, I would again like to thank you for your kind invitation and say now how pleasurable I have found it today to be with you. And finally, I would like you all to feel free to come to our UNESCO Office here if there is anything which you feel we may be able to do for you.

A SURVEY OF FISHERIES EDUCATIONAL INSTITUTIONS

ANDRES M. MANE
and
MARIANO A. ABAGON
Bureau of Fisheries

Advances in fisheries biology and technology greatly increased the necessity for fishing countries to consider the problem of technical training of fishermen. Consequently, these countries have established fisheries schools whose programs of education range from the training of specialists in the different phases of fisheries to the vocational training of fishermen. These training programs have been developed to best exploit the peculiar features of their fisheries potentials.

Thailand, which is basically an agricultural country, has developed a system of irrigation canals for the raising of agricultural crops. The resourceful Thai have utilized these networks of waterways and the rice paddies for the culture of fish. Because of the facility with which this type of fishery is favored, Thailand far outrivals its neighboring countries in the production of fresh-water fish. This peculiar condition makes the Thai fishermen intimately related to the agricultural activities of the country, and consequently the technical training in fresh water fish farming at the local agricultural college at Bangkok is given in conjunction with the instructions in agriculture. This college offers a three-year course dealing with fish culture, fisheries biology, economics, chemistry, language, fish capture, fishery laws and mathematics. Fish culture and fisheries biology cover about half of the total number of hours devoted to the entire course.

In Australia, the training in fisheries is limited to ex-servicemen, to rehabilitate them, admission being based on the suitability and adaptability of the applicant to the industry. The fisheries course covers only a period of twelve months, four at Cronulla and eight at subsidized employment. The trainee goes through a somewhat crowded curriculum consisting of fisheries technology, fisheries economics, fisheries biology, fisheries administration and legislation, seamanship, navigation, meteorology and food technology. Fisheries technology includes a detailed study of fishing grounds, oyster farming, freshwater fisheries, fishing gears, boat construction, and marine fisheries. Fisheries economics includes methods of world fisheries, factors of production and distribution, such as mar-

keting, transport and port facilities. Fisheries biology includes the study of the fish, the physical, chemical and biological properties of ocean water and research methods. Fisheries administration and legislation comprises fisheries management, legislation and international agreements. In seamanship, navigation and meteorology, the trainees are given full responsibility in the management of a fishing craft. Food technology includes the proper handling of fish transport, preservation, refrigeration and processing. Of the three major courses in fisheries, fish capture is apparently given more emphasis in the instructional set-up.

Graduates of the school are expected to fill vacancies in the executive or administrative branches of the government or to replace fishermen of private fishing operators. According to estimates, the Australian fisheries have a total annual replacement requirement of several hundred full-time operatives.

While the provision for the establishment of the school of fisheries belongs to the Reestablishment Division, Ministry of Post-War Reconstruction, the Director of Fisheries, Common wealth Fisheries Office of the Australian Department of Commerce and Agriculture was made the administrator of the institution. From such arrangement it becomes obvious that the school operates only when trainees are available.

In Norway where fishing is the principal occupation of the people, there are three schools of fisheries. In all these schools a common fishing master course is offered. Usually, a graduate obtains a coaster skipper certificate, first class, which qualifies him to operate a fishing vessel. He is also required to pass an examination on fisheries subjects which are common to the three schools. The fisheries course extends over a period of ten months. The first five months are devoted solely to navigation while the last five months are spent in the study of fisheries and related subjects such as marine biology, use and maintenance of fishing gear, survey of fishing grounds, fishing methods, elementary oceanography, fish curing methods, physics and chemistry, civics, bookkeeping, language and hygiene.

A short course is also offered in addition to the regular ten-months course. By this the student is afforded an opportunity to specialize in such subjects as navigation, cooking, radio-telephony, bookkeeping, marine engine maintenance and repairs, use of electrical equipment and maintenance of echo sounders.

The close coordination of the instruction in navigation with fisheries and related subjects in such short time is to develop the skipper-master fishermen type which no doubt is aimed to reduce cost of operation in the industry.

Equally concerned with the status of her fisherman is Scotland which in 1945 established the Aberdeen Fishery Boarding School under the administration of the Scottish Fisheries Department. The school, according to its set-up, aims to mainly train young students in the arts and sciences of fish capture. It provides a curriculum for trawl and line fishing, sea cooks, net makers, fish curers and fish traders. Each course may be completed by a student in 9 months, 3 months at school, 3 months at sea and back to the school for the last 3 months of training. The trainees take practical lessons in navigation and fishing on board a training ship of about 105 feet long which is well-equipped with outfits for otter-trawling, seine-netting, line fishing and drifting.

The syllabus of instruction is grouped into technical and general subjects. The technical subjects comprise the following: marine biology, organization and technique of fishing, knowledge of fishing vessels, preserving and storage of fish on vessels, netmaking, mending and splicing, navigation, nautical astronomy, rules of the road at sea, meteorology, fishing laws and regulations, first aid, practical training on fishing vessels. The general subjects include economic geography, arithmetic, English and physical exercises. From its set-up no subjects are offered in fish culture while a subject in preserving and storage of fish on vessels is offered.

In the United States a high level of technical training in fisheries science is offered at the School of Fisheries, University of Washington, in Seattle. The fisheries course is designed to enable students to develop their chosen fields in fisheries biology research or in technology and is not intended to drill them in particular methods. The training qualifies the graduates for big jobs such as consultants in fishery matters, administrators of fisheries, executives and researchers.

Together with the help of public and private entities the school was able to place fisheries work on a high industrial level. It has, likewise, succeeded in wresting from local politics all matters pertaining to fisheries work and has effectively carried out a pattern of practical conservation work, the principles of which have been fully appreciated, followed and practiced by the people.

Two curricula are offered in the school; namely, elective curriculum and prescribed curriculum. The elective curriculum does not carry sufficient subjects in fisheries. The prescribed curriculum, however, embodies the following major courses: commercial fishery management, fresh-water fishery management and commercial fishing industry. Divided into six quarters of sixteen credits each the two years preparatory subjects

are implemented by an additional forty-two credits taken in the third and fourth year of the course. The subjects offered in the preparatory course are: Language, zoology, mathematics, fisheries, chemistry and physical education.

Optional subjects for commercial fishery management are: fisheries, mathematics, and zoology. For fresh-water fisheries management, subjects dealing with higher studies in fisheries, chemistry, microbiology and mathematics are offered. In commercial fishing industry advanced subjects in fisheries, chemistry and microbiology are required.

To graduate from any of the three major courses a student must obtain a rating of 2.5 grade-point average in all subjects.

In Japan fisheries education and research have been given more governmental support and encouragement than perhaps in any other country in the world. Even as she lies prostrate as a result of her defeat in World War II, the training of her man power in the higher levels of fisheries education proceeds unhindered. Increased population, meager food resources and geographical attributes combine to make her a powerful fishing nation and the Japanese the best fishermen in the world.

Japan operates a total of 37 institutions offering courses in fisheries science. Of these, 32 are prefectural schools or middle schools, two are of the collegiate level and three are departments of fisheries attached to the colleges of agriculture of the Imperial universities located at Hokkaido, Tokyo and Kyushu.

The prefectural schools are open to graduates of the six-year elementary schools and are distributed in such a way that there is one or more schools in nearly every prefecture. Graduates of these prefectural schools are expected to become expert fishermen, cannery foremen and net makers. The subjects covered are fisheries, zoology, hydrology, fishing boats, practical boat exercise, navigation, wireless telegraphy, machinery, drafting, meteorology, mathematics, music, English, history, ethics, and geography. These subjects are completed in four years and graduates of prefectural schools are eligible for admission in fisheries colleges.

The two fisheries colleges in Japan are the Hakodate Fisheries College and the Tokyo Fisheries College (Imperial Fisheries Institute). These two colleges offer courses of three to five years duration according to the type of study selected. The Tokyo Fisheries College is the oldest fisheries school in Japan. It is the only school of fisheries that is not under the supervision of the Ministry of Education. It operates under the Ministry of Agriculture and Forestry.

The college curriculum is divided into three sections: The regular course, post graduate course and the pelagic course. The regular and post graduate courses are each subdivided into fishing, technological and fish culture courses. The regular course requires three years to finish, after which the student may take advance subjects in either post graduate or pelagic course. The post graduate and pelagic fisheries courses are finished in two years and only highly qualified graduates of the regular course are eligible.

The courses of instruction are as follows: general and aquatic zoology, general and aquatic botany, ichthyology, bacteriology, fish diseases, chemistry, oceanography, meteorology, history of fishes and fishing, fish culture, fishery laws, practical exercises in fish canning and processing, mathematics, physics, English, German, economics, finance, merchandizing, navigation, seamanship, theory and manufacture of fishing gear, principles of fishing boat construction, diesel and steam engineering, machine designing, practical exercises at sea, swimming, rowing and first aid.

The instructional facilities of the fisheries colleges are greatly augmented by the many government-supported fisheries and marine products research stations and sub-stations. Of these stations, six are operated by the central government and 112 by prefectures.

In the universities the courses of instruction in fisheries include the following subjects: zoology (general and aquatic), botany, plankton, oceanography, properties of natural water, principles of fisheries culture of aquatic products, methods of fishing, technology of fishery products, hydrobiology, bacteriology and pathology, animal histology and embryology, organic chemistry, refrigeration, fisheries law, applied meteorology, fishing boat machines, fishing boats, and a seminar in fishing. The student is required to finish the curriculum for three years after which he is awarded the master's degree.

In addition to the instructions offered by the universities the facilities of fisheries research stations, fishery experimental stations and marine biological stations are available to the fisheries student. Researches made by the faculty and the students are published in the Journal of the College of Agriculture, Journal of the Faculty of Science or in the Zoological magazines.

In Canada two fisheries schools are actively operating. They are the School of Fisheries at Dalhouse University and the School of Fisheries at Laval University, St. Anne de la Pocataire, Quebec. The fisheries curriculum at Dalhouse University leads to the degree of bachelor of science in fisheries. Instruction in the two universities is conducted in French and

only a few subjects in English. Students of any country who are proficient in the French language are admitted in these schools. The Fisheries School at Laval University gives instruction in fisheries to train students in the methods and techniques of commercial fisheries and in the proper handling and preservation of fishery products.

In accordance with the instructional set-up of the school, basic science subjects such as chemistry, physics, mathematics, biology, political economy, oceanography and geography are given in the first two years of the course while practical training in fish capture and fish preservation are offered in the last two years of the curriculum. To balance the theoretical part of the instruction with practical training, the students are afforded extensive work in navigation, use and maintenance of fishing gear, fishing techniques both in-shore and off-shore. Likewise, fisheries production work are covered up in subjects such as preservation and manufacture of fishery products, biochemistry, bacteriology, technology of refrigeration, canning and curing of fishery products. Students in applied economics implement their training by helping the public organize cooperative stores and fish production cooperatives throughout the country. This practical training prepares a student along scientific management of fishery resources and administration of fishery enterprises through rationalized production, conservation, protection and proper distribution of the products.

In this school, training in fish capture, fish preservation and fishery economics are well emphasized while not a single subject dealing with fish culture is given. Religion seems to be a prerequisite subject and this study is carried on consistently from the first year to the fourth year of instruction.

In the Philippines where fish ranks next to rice in importance as an article of diet of the people, considerable interest in the conservation of the fisheries resources has been generated by the general clamor for action against the rampant fishing by illegal methods. The Philippine Institute of Fisheries Technology, formerly the Philippine School of Fisheries, was established under the Bureau of Fisheries. Originally intended to train fishermen along the various phases of the fisheries industry, it was later expanded to include research training and extension service. It now offers three complete courses of two and one-half years each; namely, fish capture, fish culture and fish preservation. The subjects for the first semester are common to all courses and are intended to orient and introduce the students to the subject matter to be pursued later and to guide them in the selection of the course they intend to specialize. These subjects are: zoology, botany, chemistry, general fisheries and national language.

In the second semester of the first year the students choose their field of study from the three courses. The subjects offered in the fish capture course include the construction of fishing gear, their preservation, classification and repair, seamanship, navigation, oceanography, meteorology, mechanical drawing, blacksmithing, carpentry, swimming and boating and methods in off-shore and deep-sea fishing. For the course in fish culture, the following are offered: engineering, plane surveying, limnology, fish diseases, fresh-water and salt-water fish cultivation. The course in fish preservation includes the following subjects: analytical and organic chemistry, bacteriology, refrigeration, standardization of fish recipes and canning of fish and fisheries products.

Practical training of six months in the particular course he has pursued is required of every student prior to graduation. This training is accomplished by assigning each student to a particular fishing establishment operating in the country.

THE FUTURE OF THE TRAWLING INDUSTRY IN THE PHILIPPINES

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Although commercial trawling of bottom fish is a new development in the Philippines, it has grown in recent years to one of the most important segments of the fishing industry. The introduction of the trawling gear into the Philippines has been primarily instrumental in the development of mechanized fishing here. This gear has also marked the beginning of the big business in the fresh-fish industries the world over today. It is the fishermen's contribution to steady mass production of fresh fish at minimum cost and its operation is almost independent of the weather. The trawl industry here, as abroad, has been and will continue to be, if properly managed and regulated, one of the mainstays in the nation's need for a relatively cheap fish supply.

The idea of trawling was first initiated by the Japanese fishermen in 1900 with the use of small sailing sampans towing three to four beam trawl (*utase*) nets. In 1928 these small sail-powered trawlers were gradually replaced by Diesel-powered ones towing one big net. Since 1940, the more advanced trawling gear, the otter trawl, has been experimented by certain private operators. Through the joint efforts, however, of the Bureau of Fisheries and the U.S. Fish and Wildlife Service Rehabilitation Program, it was finally adopted by the industry in 1948.

This development of the trawl (otter and *utase*) industry during the last two or three years was so rapid that in the early part of 1950 the trawling industry became one of the most heavily-capitalized sea industries with an aggregate investment of about 10 million pesos. The estimated total catch of the 224 trawling vessels was between 25 and 30 million kilos valued at no less than 20 million pesos. This is about 30 to 35 per cent of the total fish landed by registered vessels of more than 3 tons gross. The number of trawlers, according to latest reports, is still on the increase and it is probable that by the close of 1950 the number will reach to about 300 operating units consisting mostly of modern otter trawlers.

Of late, this industry has been the subject of varied speculations and prognostications. Let us take an account of this

industry. A close study of the physiography and extent of our coastal shelf will at once convince us of the futility of the Philippines becoming a major trawling nation. The bottom resources within the territorial waters of the Philippines are certainly not vast enough for this purpose. The trawlable shelf is very limited in extent and the nature of the bottom is generally rocky except in some bays, gulfs, and sounds. These conditions are generally adverse for any extensive dragging. During the first half of this century all our profitable trawling operations have been confined to the shallow coastal areas within the 40-fathom line. The existing dragging grounds of Lingayen Gulf, Manila Bay, Ragay Gulf, Carigara Bay, Southern Masbate, Southwest Samar, Guimaras Strait, Northern Capiz, Western Visayan Sea, Panguil Bay and Sibuguey Bay have a combined trawlable area of only about 4,500 square miles. This is evidently very limited considering the number of trawlers now in actual operation here. Neither has deep-water trawling to the 100-fathom line shown any promise as indicated by recent otter trawl explorations. Compare this with deep-sea trawling in higher latitudes as in the West Coast of the United States and along the English Channel where very promising trawling grounds are found at depths up to 250 fathoms.

Our existing local trawling grounds, in general, are not overly rich. Recent exploratory assays showed that the production per hour with the use of a 120-foot otter trawl net varied from 50 to 220 kilos of marketable fish with an over-all average of about 68 kilos. This catch rate appears to compare favorably with other tropical areas of the world. However, in the higher latitudes the catch rates are about 30 to 50 times our rate.

This great disparity in the rate of catch is likewise true of pelagic fisheries. Tropical areas, as a rule, exceed the higher latitude in the number of species but fall short in poundage and size of the commercial species taken. This may be attributed to some undetermined biological and hydrological factors obtaining in these tropical areas. The apparent absence of certain hydrodynamic processes involving vertical diffusion, convection overturn and up-welling in our waters is possibly the main contributing factor.

There has been a general indication of over fishing our existing trawling grounds. Computed on the allotment basis, our present number of 224 trawlers can only be allowed about 20 square miles of trawlable space. Using a 120-foot net and dragging at an average speed of one and a half miles and fishing 12 hours a day, an average trawler can easily fish

this allotted area in about 90 days. Therefore, in a normal 240-day annual operating period, the same vessel will be forced to fish the remaining 150 days of the year in the same or in an area occupied by another vessel. Such an unavoidable practice would be detrimental to the fishery and may eventually lead to depletion. Our bottom resources here do not possibly have the capacity to rehabilitate fast enough within a period of 90 days in order to maintain a sustained commercial yield in the fishery. It is estimated that under normal conditions this fishery here can only fully or partially recuperate from the strain of trawling operation in about three to four years. This has been amply demonstrated during the partial cessation of trawling activity in Manila Bay during the Japanese Occupation period (1942-44).

In view of this intensive dragging operation which has been going on during the last four or five years, the trawl fishery has undergone considerable decline both in poundage and quality of the catches per vessel. To bring home the usual profitable fare the fishing trips have been likewise prolonged from one to three days for bay operation and from 12 to 20 days for outside operation. New areas consisting of narrow and small patches of the open coastal shelf are being dragged, often resulting in the wholesale loss of gear. Even these areas cannot be expected to withstand protracted and intensive dragging operation because of their limited extent and relatively low production rate.

With this ominous sign threatening the industry, the big question is: "What shall we do or where do we go from here"? There are two possible solutions to save the industry; namely, (1) to regulate the operation of the vessels through reduction of operating units or diverting some to other prospective ventures, and (2) to venture into the existing international grounds off Southern China and the Gulf of Siam. The first solution, although a wise conservation policy, will unavoidably bring economic disaster to certain sections of the industry. However, a large number of the sampan-type trawlers can be economically converted and profitably operated as tuna longliners. Today, tuna long-lining is one of the most promising high sea fishing ventures in the Philippines. The pre-war and recent initial successful operation of tuna long-liners by the Japanese and Formosan fishermen here has blazed the trail toward the development of this important industry which will harness resources hitherto untapped by Filipino fishermen. This will also develop important export products such as frozen and canned tuna. Fish meal, as a by-product, will aid the growing poultry industry.

The second solution is most logical as it will have a decided economic advantage on our part for two reasons. First, the opening of international trawling will inevitably remove the present strain on our local trawl fishery; and second, it will increase the landings of fresh fish, thereby ultimately lowering the price especially in population centers of the Islands. These existing international grounds are not only naturally richer but they are also more extensive than ours. There is an estimated trawlable area of about 450,000 square miles along the Southeast Asian Shelf. Before the war the Japanese with their home base in Japan used to operate in these areas, but presently only the Chinese are operating there. These areas are between 600 and 900 nautical miles from Manila equivalent to a normal fishing trip of from 20 to 25 days.

Two systems of operation may be adopted in this venture; namely, (1) the mothership-trawler system, and (2) the independently-operated trawler system. The first system involves the employment of a mother-ship carrier and a fleet of medium-sized trawlers which we now have in the Philippines. The second system will require the employment of specially built ocean-going trawlers costing from 100,000 to 150,000 pesos each with a payload of from 80 to 100 tons per trip.

The success of this venture will depend primarily on three main considerations; namely, (1) capital, (2) technical know-how, and (3) international cooperation. All these considerations with the exception of the third, are obtainable in the Philippines today. The third consideration will require certain international agreements between the neighboring countries concerned. The recent organization of the Indo-Pacific Fisheries Council will facilitate the realization of any international cooperation in fisheries development in this part of the Western Pacific.

With all these basic considerations taken care of, there is no reason why the Philippines, like Japan, England and other maritime countries cannot develop the aquatic resources beyond her shores and become one of the leading fishing nations in the Western Pacific Area.

MANAGEMENT OF SOME PHILIPPINE FISHERIES

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FISHERIES MANAGEMENT ABROAD

A review of the fisheries activities of some of the leading countries of the world reveals that leadership along these lines has been the result of definite planning adjusted to the means and needs of each individual country. Japan, for example, as early as 1897 had a definite knowledge that her inland and coastal fisheries were already depleted so her government had to resort to subsidizing fishing vessels of more than 50 tons gross as well as sailing vessels of more than 30 tons. In 1905 the lower limit of tonnage of subsidized fishing vessels was reduced to 20. Japan had to develop offshore fisheries knowing that to rehabilitate the depleted condition of her inshore and coastal fisheries would not be commensurate with the cost and would still not be sufficient to cope with her increasing fish requirements. Following a systematized and workable plan, Japan from 1897 to 1941 achieved an unprecedented leadership in all lines of fisheries endeavor. Fishery cooperatives reached a very high stage of organization and the overall fishing activities of the entire country were merged under the management of four major fishing companies which were perhaps the largest in the world. The capitalization of each of these companies ranged from 10 million to 47 million pesos. Their operations covered trawling, seining, tuna fishing, crab processing in floating canneries, coastal and deep-sea whaling, canning, smoking and salting salmon and salmon caviar. In addition to the actual output of fish products these companies had extensive cold storage holdings, boat-building and repair shops, machine shops, net factories and other facilities required for self-maintenance.

A few years before the outbreak of World War II Japan had to re-examine her offshore fisheries policy for a more workable plan adaptable during the times of emergency. From the very lucrative offshore fisheries she had to switch all her technical know-how to the development of inland fisheries knowing that this would be the mainstay for fish supply for the whole country during the war. Thus, in 1943 her aquiculture

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produced 250,000 tons of fishery products compared to the yearly average output of 140,000 tons from 1931 to 1938. The main products were carp, eel, mullet, trout, oysters, clams, other edible shellfish and seaweeds.

The United States, on the other hand, concentrated all her efforts to the development of her salmon and halibut fisheries with which Nature richly endows her waters. Salmon is considered the most valuable fishery of the United States, with an annual yield of 270 million kilograms. About 85% of this is canned, and the rest sold fresh, frozen, smoked or cured. Salmon hatcheries were started as early as 1870 for the purpose of conserving the fishery. The operation of these hatcheries resulted in enlarged salmon runs and effectively counteracted the many unfavorable conditions brought about by population and industrial growth such as pollution, deforestation, irrigation diversions and dams.

The United States and Canada lead the world in practical international cooperation with reference to ocean fisheries. The International Fisheries Commission created by treaty between these two countries has made much progress in restoring the badly depleted halibut fishery of the Pacific Northwest. The success of this commission has encouraged the two countries to negotiate on another treaty to restore the once great Fraser River sockeye salmon fishery of the boundary region of British Columbia and the State of Washington. This treaty provides for the appointment of the International Pacific Salmon Fisheries Commission to investigate the natural history of the sockeye salmon of the Fraser River system, hatchery methods, spawning ground conditions and related matters. Lately, the Fisheries Research Institute was created by the Board of Regents of the University of Washington to provide for research projects concerning the Alaska salmon fisheries. These projects are financed by the canners in Bristol Bay, Southeastern Alaska and Kodiak Island, and seek to understand the changes in abundance of fish, the effect of fishing and the regulation needed on the fisheries. These research undertakings are perhaps the first of their kind being managed by private interests.

An extensive American program is now underway, based on Hawaii, for the understanding and exploitation of the yellowfin tuna and skipjack in the entire Pacific. Heretofore tuna fishing has been confined to the eastern Pacific bordering the American continent from California to Peru.

One of the biggest producers of fish in Europe is Norway which produces around one million tons every year. The cod is Norway's most important fishery and is the basis for such

products as stockfish, klip fish, cod liver oil and roe. The Norwegian medicinal cod liver oil production amounts to about 10 million liters annually.

Norway's fishing activities are carried on along the coast in the North Sea, off Iceland and Greenland, at Baer Island and Spitzbergen and in other Arctic Regions. The bulk of the cod produced by Norway comes from the region north of the Arctic Circle. This wide range of fishing operation is due to the appearance of great shoals of fish feeding or spawning along the coast at different seasons of the year.

In Norway the preparation of fresh fish for exportation is emphasized in response to the growing tendency in the world to give fresh fish greater prominence in the dietary. Another good reason for its expansion is the development of modern chilling and refrigerating techniques in Norway, and the exceptional facilities for the transportation of fresh fish. All these developments enable Norway to export its fresh fish to various distribution centers on the continent in a very short period of time.

PHILIPPINE FISHERIES

The total amount of capital invested in Philippine marine fisheries is around ₱170,000,000.00. The estimated production for 1948 was 195,000,000 kilograms valued at ₱163,500,000.00. For this same year we imported fish and other fishery products worth ₱28,278,878.00. Our population in 1948 was placed at 19,234,182. Our nutritionists estimate the Philippine per capita fish consumption at 31.32 kilograms. On the basis of this figure our fish consumption for 1948 is computed at around 620 million kilograms. For our normal fish protein requirement, therefore, our annual fisheries production is short by about 425 million kilograms. The Philippine fishing industry is now confronted with the pressing problem of how to produce more fish and overcome this shortage. The difference between local supply and demand for fish will further increase as our fish production tends to decline as a result of unarrested depletion and as our population increases. A program of fisheries development to meet this shortage can be formulated and executed by a proper understanding of the underlying causes of under production and an accurate re-evaluation of our fisheries potentials.

Geographical Location, Climate and Hydrography of the Philippines

The Philippine Archipelago extends from Saluag Island in the Sibutu group (4°35'23"N latitude) to Y' Ami Island

(21 07'26" N latitude), a distance of 16°32' of latitude; and and from West Pt., Balabac Island (116°55'39" E longitude), to Pusan Pt., Mindanao (126°36'1" E longitude), a distance of 9°40' of longitude. Its coast line has a total length of 11,444 miles. It lies within the tropics and consequently within the trade-wind belt and belt of equatorial calms. The climate is predominantly maritime, almost entirely governed by three main wind currents, namely, the trade wind (March to May), the southwest monsoon (May to October) and the northeast monsoon (November to early March). From June to November the wind system is complicated by the typhoon, a cyclonic wind with a diameter of from 500 to 800 kilometers, which rotates counterclockwise about an area of low barometric pressure. This low pressure area travels from east to west across the area from northern Mindanao to Japan.

The submarine topography of the Philippines reveals the presence of deep-sea troughs and shelves. The most notable deep of the Philippines is a trough which lies east of Samar and Mindanao and which, according to the *Emden* soundings, has a general depth of 9,000 meters with a maximum of 10,793 meters. This depression is considered the deepest in the world. Within the Sulu Sea are coral atolls such as those of the Tubbataha and the Cagayan Islands. Soundings only 2 miles off Tubbataha indicate depths of more than 2,000 fathoms. The Palawan trough, Ticao trough, the shelves and troughs of southeastern Luzon, the Mindanao Deep and the Celebes Sea Deep are among the most important features of our undersea topography. The Philippines being volcanic in origin, has steep sides with very narrow coastal shelves. These small strips of shallow water support the bulk of the Philippines fisheries.

Malampaya Sound

Malampaya Sound in northern Palawan is about 2-1/2 miles long and 2-1/2 miles wide. Its sheltered waters vary from 66 to 120 feet in depth. The bottom is generally sandy, muddy, shelly, and coralline. For a long time this small body of water has been one of the most important sources of pelagic species of fish such as cavallas, mackerels and bonitos. The importance of its fisheries may be gauged from the fact that during the years before the war, fish caught in this Sound represented as much as 85 per cent of the fresh fish sold in the Manila markets during at least three to four months of the fishing season of the year.

Barely five years after the war fishing activities in Malampaya Sound showed that its fisheries were being depleted fast. This depletion was the result of a number of factors,

notably mismanagement due to the unsound practice of the municipal authorities controlling Malampaya Sound of awarding exclusive fishing rights to a few individuals. This practice naturally leads to abuses by the concessionaires and the employment of destructive methods of fishing.

Fisheries of the Visayan Sea

The sardine fishery of Estancia and Gigantes Islands, formerly very productive, is now depleted as a result of overfishing with the bag nets employing lights and the extensive use of fish poisons and explosives.

Fisheries of Manila Bay

The Manila Bay fishery once famous for shrimps, sardines, and demersal fish has also been overfished to such an extent that certain industries supported by it are now nonexistent. The smoking and the salting of sardines were once flourishing industries in Rosario, Cavite, Navotas, Rizal and other towns bordering Manila Bay.

Fisheries of Lake Taal and the Pansipit River, Batangas Province.

The Pansipit River fishery at present under the jurisdiction of the municipalities of Agoncillo, Taal and Lemery in the province of Batangas is also being depleted as a result of mismanagement. A system of barriers thrown across the whole width of the Pansipit River collectively called the Baklad Pansipit prevents the migration of fish about to spawn from Lake Taal to Balayan Bay. The Pansipit fishery is another example of a natural resource belonging to the entire nation being managed according to the discretion of the municipal councils of the above-mentioned municipalities. They give the exclusive privilege of exploiting the fishery to the highest bidder who in turn is compelled to catch as much fish as he can to pay for the high cost of the lease and in this way such commercial species in Lake Taal as the carangids, eels, mullets and milkish are not given a chance to reproduce.

Fisheries of Lake Naujan on Mindoro Island

The mullet fishery of Naujan Lake in Mindoro Oriental is similarly managed as the Pansipit river fishery. Mullets returning to the sea from Naujan Lake to spawn are caught in the baklad or fish corral set across the Butas River. Almost all of the mullets caught in this barrier are sexually mature.

Fisheries of Laguna de Bay

The fisheries of Laguna de Bay which supply fish to the many towns of Rizal and Laguna provinces are now almost totally destroyed. Over-fishing with the use of pukot is the principal cause. The lake is now very shallow due to the continuous deposition of silt and mud from the deforested mountains around. The snails and shrimps which are important food for the kandule are getting scarce for they are intensively gathered to support the great duck industry that has developed around the lake. The problem of rehabilitating the fisheries of Laguna de Bay is complicated by the fact that any form of management will have to take care of socio-economic and political aspects of conservation as well as the increasingly unfavorable ecological conditions obtaining in the lake.

The Bangos Fry Industry

The bañgos fry industry worth about a million pesos plays an important role in our economy because on it depends the continuous operation of our fishpond industry in which around 300 million pesos have been invested. About 200,000,000 fry are annually needed to stock the present fishponds of about 70,000 hectares. The supply of fry fluctuates each year and not much is known about the breeding and spawning habits of the bañgos. The spawners are usually caught in fish corrals set along the coasts and a great number of them are killed with the use of explosives.

The Ipon (goby fry) *Fisheries*

The goby fry or ipon fisheries of the Ilocos Provinces and Northern Mindanao, are quite important although at present, except for the making of bagoong, they are not as yet fully developed. Young gobies, if properly studied with respect to their habits, might serve as additional stocks for our already depleted freshwater units like Laguna, Taal, Naujan and other lakes.

After reviewing the fisheries activities of some of the leading countries of the world one will notice the fact that each follows a definite plan of work based on a long range program. Japan, for example, developed her off-shore fisheries with the knowledge that to rehabilitate the depleted condition of her inshore and coastal fisheries would be very costly if not next to impossible. The United States concentrated all her efforts on the development of her salmon and halibut fisheries with which Nature provides her with abundance and lately, she is engaged in the production of tuna which is considered a world fishery. Norway, on the other hand, developed the

cod and herring fisheries which are abundant in her own waters. In all these undertakings, the above countries are always guided by the results of organized research. Many examples can be mentioned of how research helped the development of important world fisheries but the most outstanding among them are the International Halibut Commission and the Fisheries Research Institute already mentioned above.

In the Philippines our need for a definite policy relative to the development of a certain fishery should receive top consideration. The immediate problem is how to produce more fish to feed our ever increasing population. The points to consider in this connection are: Shall we develop our offshore fisheries or our inland fisheries including the fishponds? Developing offshore fisheries would mean fishing in international waters, following migration of pelagic fishes of commercial importance to their feeding, breeding, and spawning grounds which may happen to be in waters belonging to other countries. In other words, offshore fishing for the Philippines would be mostly international in scope as it is in other countries. Are we ready to engage in this kind of fishing which will require technical know-how and millions of pesos as capital?

AVAILABILITY OF CALCIUM IN BAGOONG AND DILIS [1]

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Bureau of Fisheries

INTRODUCTION

The results of several dietary surveys have shown that a large proportion of family food supplies all over the world have calcium contents too low to be satisfactory. This is particularly true in the Orient where a large proportion of the population live mainly on cereals, fish, a few vegetables, and almost no milk. A typical Filipino, for example, derives most of his calories from rice and depends to a great extent upon fish and vegetables for minerals. Calcium-deficient diets have also been found in India, China, in a large district of Australia, England. Scotland, and even in the United States. There seems, therefore, to be no doubt of the reality of a widespread calcium problem in human nutrition.

It is generally known that milk is an excellent source of calcium. Steggerda and Mitchell (1945) stated that the calcium in milk is best utilized by man and its availability is not altered in homogenized, pasteurized or otherwise heat-treated milk. The green leafy vegetables and certain fish products are perhaps the next most important sources of calcium after milk.

In view of the scarcity of milk and milk products in the Philippines and the comparatively large amount of calcium required for optimum health, an experiment was made to determine the availability of calcium in two typical and widely used fish products, namely, salted fish paste and dried anchovies, generally known as bagoong and dilis. respectively. In this experiment both the bagoong and dilis were made from the Philippine anchovy, *Stolephorus commersoni.*

Bagoong is a fermentation product of fish and salt, with or without the addition of condiments, flavoring material, or

[1] Department Problem submitted for the Degree of Master of Science, University of Massachusetts, Amherst, Massachusetts, May, 1950. Research was conducted by Olympia B. Navarro during her one year training grant under the auspices of the U.S. Fish and Wildlife Service, Department of the Interior. Permission to publish this paper in the Philippines was given by Dr. C. R. Fellers of the University of Massachusetts who was the major professor of Miss Navarro.

coloring matter. Dilis are sun-dried small whole fish, commonly chewed after frying. A chemical analysis of bagoong and dilis indicates a high percentage of calcium. Table 1 shows that both have higher percentages of calcium than milk and it was therefore considered important to determine whether the bones of these small fish which account for the high calcium content may be counted on to provide a good source of available calcium.

Table 1

Chemical Analysis of Milk, Bagoong, and Dilis

	Milk (whole)[1]	Bagoong[2]	Dilis[2]
	Per cent	*Per cent*	*Per cent*
Moisture	87.6	54.7	15.4
Protein	3.3	16.9	68.1
Fat	3.5	0.8	3.7
CHO	4.7	——	——
Fiber	——	0.1	0.3
Ash	0.7	25.9	14.0
Salt	——	21.4	4.3
Calcium	0.12	0.88	2.6
Phosphorus	0.09	0.5	2.0

A review of literature on the availability of calcium in fish bones reveals very little information on this subject. Basu, Basak, and De (1942) performed calcium and phosphorus balance experiments on human subjects and found that about 45 per cent of the calcium and 44 per cent of the phosphorous of small unboned fish was retained and showed that the eating of small fish complete with bones, as practised in some parts of India, the Philippines and other Oriental countries, adds available calcium and phosphorous in the diet.

Lunde and Lie (1940) performed feeding experiments on rats using fish, fish bones, and milk as source of calcium, and reported 93.8 per cent utilization for milk, 92.1 for canned sardines, and 94.7 for fresh brisling. The then United States Bureau of Fisheries likewise reported that the calcium of the bone of canned salmon is nutritionally available.

A comparison was made by Drake and co-workers (1949) on the utilization of the calcium of skim milk powder and

[1] Data taken from Canned Food Reference Manual, 1949, 3rd ed., p. 385.
[2] Analysis performed at the Feed Control Laboratory, Massachusetts Agricultural Experimental Station, University of Massachusetts, on commercial samples from Manila.

of bone meal by humans and they concluded that the availability of the calcium in bone meal is of the same range as that of milk. They found that the retention of calcium from whole cooked ground bones by rats was approximately 90 per cent of that from whole dried milk.

METHODS

The procedure in this experiment was essentially that developed by Drake and co-workers (1949) in their work on the utilization of calcium in bone meal by rats. Young, healthy, albino rats about 28 days old and weighing approximately 57 grams were placed in individual cages with raised screen bottoms under which paper towels were placed to prevent any loss of spilled diets. Litter mates of the same sex were matched and the rats were selected so that the initial weight of each of the five groups in the experiments were approximately the same.

Four of the five experimental diets contained calcium in the form of the substances to be tested. The fifth experimental diet used as a control contained only a negligible amount of calcium about 0.06 per cent, derived from the casein present in the diet. A low calcium diet devised by Robertson and Doyle (1913) was used as the basal ration. In this the phosphorous and other elements were normal. The salt mixture was prepared without calcium salts. Table 2 shows the composition of the experimental diets and their calcium content.

Forty rats were divided into five groups of eight. The first, second, third, and fourth groups were fed experimental diets containing calcium in the form of $CaCO_3$, milk powder, bagoong and dilis respectively.

Bagoong, a semi-liquid product, was first dried in an oven at 70°C and then finely ground to pass through a 40-mesh sieve. Dilis, a dried product, was thoroughly ground to insure a uniform mixture of the experimental diet.

The experimental rations were prepared in sufficient quantities to last for the duration of the experiment. They were placed in stoppered bottles and refrigerated.

The animals were fed *ad libitum* for a period of four weeks. Distilled water was available. A careful record was kept of the food consumed by each individual rat. Any spilled food was carefully separated from the feces and weighed to get an accurate amount of the food eaten by each individual rat. The experimental animals were weighed at the end of each week.

Table 2

Composition of Diets and Their Calcium Contents

Ingredients	Ration				
	$CaCO_3$ diet	Milk powder diet	Bagoong diet	Dilis diet	Control
	%	%	%	%	%
Casein	18	13.5	14.3	13	18
Cornstarch	61.7	69.2	55.8	59.5	62.2
Crisco	10	3	10	10	10
Yeast	6	6	6	6	6
Cod liver oil	2	2	2	2	2
Salt mixture #	1.8	1.8	1.8	1.8	1.8
$CaCO_3$	.5	—	—	—	—
Milk powder	—	4.5	—	—	—
Bagoong	—	—	10.1	—	—
Dilis	—	—	—	7.7	—
Calcium	0.238	.075	0.226	0.216	0.034

At the end of the experimental period, representative animals were weighed and killed with chloroform. The furs were brushed carefully and the tails washed to remove any adhering food. The dead rats were dissected through the abdomen and the gastro-intestinal tract was discarded to avoid the possible inclusion of food residues. Kao, Conner, and Sherman (1937) found that the calcium in the walls of the intestinal tract is negligible. Extreme care was observed during the dissection to prevent loss of blood because blood contains minute quantities of calcium. The carcasses were then carefully weighed. The carcass weight was used as the basis of all calculations.

The weighed carcasses from each group were placed in suitable containers, covered with three per cent acetic acid and autoclaved at 15 pounds pressure for four hours. This

# Salt Mixture:	*Weight (Per cent)*	*Weight (Grams)*
K_2HPO_4		219.72
KCl		125.29
NaCl		77.41
$MgCO_3$		33.43
$MgSO_4$		38.50
Kl	.30	
$K_2Al_2(SO_4)_4.24H_2O$	.67	
$MnSO_4$	1.17	13.80
NaF	3.68	
Fe citrate 1-1/2 H_2O	94.18	

procedure softened the fur, bones, teeth and flesh so that they were easily homogenized in a Waring blender. The homogenized mixtures were then weighed and a sample removed for calcium analysis. The method for calcium analysis followed was that of the Association of Official Agricultural Chemists (1945).

The experimental diets were also analyzed for calcium intake of each group. The values obtained are indicated in Table 2.

RESULTS AND DISCUSSION

The average amount of food consumed by the rats during the experimental period is shown in Table 3. All the animals fed the milk diet, powder diet, dilis diet, and bagoong diet appeared to grow normally and were apparently in good health. Loss of appetite and slow gain in weight during the later half of the experimental period were observed on the rats fed the $CaCO_3$ and low calcium diet. The difference between the weight gained by the calcium-deficient and $CaCO_3$ rats was pronounced at the end of the third and fourth week.

Table 3

Growth and Food Consumption of Rats on the Various Diets

No. of rats	Supplement	Average food intake[1]	Weight		
			Initial	Final	Gain
		gm.	*gm.*	*gm.*	*gm.*
8	None	209	57	127	70
8	$CaCO_3$	226	57	131	74
8	Milk powder	323	59	152	93
8	Bagoong	252	57	147	85
8	Dilis	286	56	166	109

To evaluate the effect of calcium on the rate of growth, a comparison of the average weekly weight of the rat in each group was made as shown in Figure 1. Each curve represents the average for the 8 rats. The decreased rate of growth of the calcium-deficient rats and the $CaCO_3$ rats is to a large extent the result of decreased appetite. The average food consumption of rats fed the calcium-deficient diet and $CaCO_3$ diet is 7 to 8 grams per day as against about 12 grams for the rats fed the milk powder, dilis and bagoong diets.

[1] Average food intake for the total experimental period.

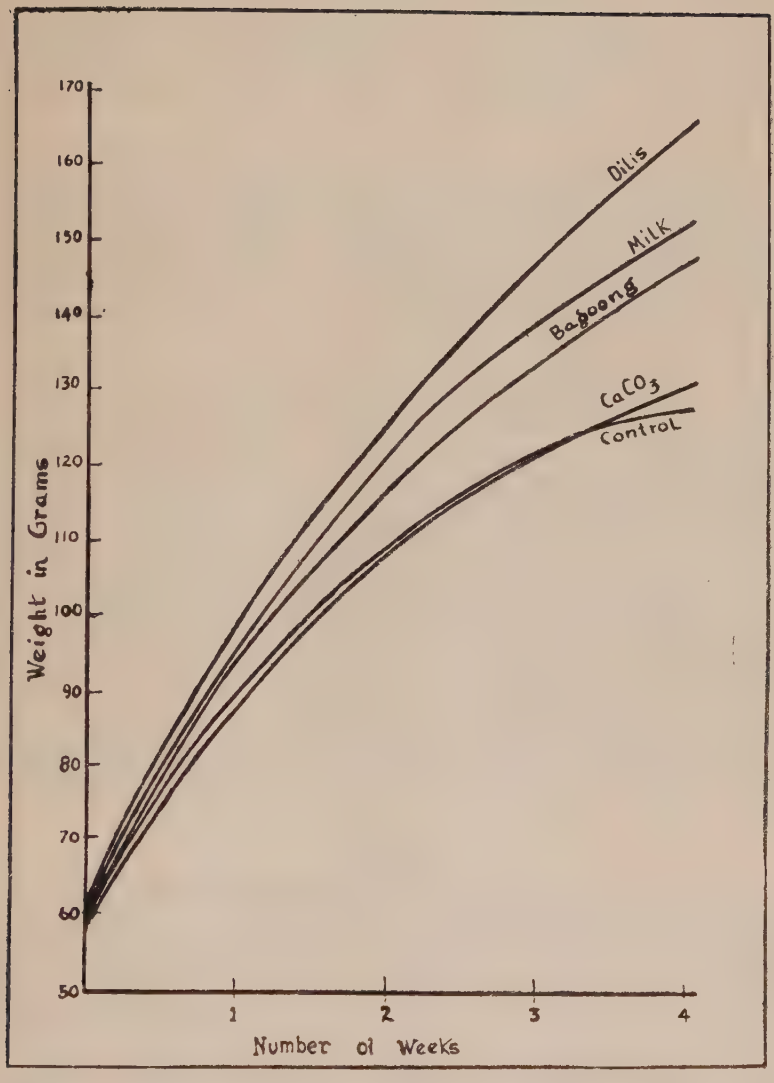

FIG. 1. Average weekly weight of rats fed with the five experimental diets.

The calcium-deficient rats showed decreased sensitivity and reactivity. In contrast with the healthy, lively rats fed the adequate calcium diet, they did not exhibit any curiosity or interest in the activity around them. They moved around the cage very little and manifested weakness and lethargy. Another outstanding effect of the low calcium diet is the susceptibility of the animal to hemorrhages. Two of the rats in this group showed bleeding of the nose and toes.

The results of the experiment are summarized in Table 4. The first column lists the substances supplying the calcium supplement. The second column gives the total amount of calcium consumed by the supplemented rats from which was deducted the calcium consumed by the rats fed the low calcium diet to give a value corresponding to the calcium supplied by the supplement only. The calcium content of the rats at the end of the experimental period are shown in the fourth column. From these figures, the extra calcium retained over and above that in the low calcium group is obtained by deducting the calcium content of the calcium-deficient control rats from that of calcium-supplemented rats, column five. The values from this column do not accurately measure the calcium retained since they do not take into account the differences which are due to variations of the initial store and the food consumed by the rats. A more significant basis of comparison between the calcium supplemented diets, the per cent supplementary calcium retained was calculated by dividing the ingested calcium supplied by the supplement by the additional calcium retained in the supplemented animal, multiplied by 100. It is apparent from these values, that the rats fed the milk powder diet exhibited the greatest percentage of calcium retention.

Table 4

The Retention of Calcium by the Rats

Calcium supplement	Total Ca consumed	Ca supplied by supplement	Ave. Ca. in rats	Additional Ca retained by supplemented animal	Supplementary Ca retained
	gm.	*gm.*	*gm.*	*gm.*	*gm.*
$CaCO_3$	539	468	845	375	80.2
Milk powder	255	184	648	178	96.8
Bagoong	262	491	789	298	60.8
Dilis	631	560	958	488	87.2
Control	71	——	470	——	——

The calcium of the dilis tested in this experiment appeared almost, if not quite, as well utilized as that of milk but the rats fed the bagoong diet stored the least calcium of any of the other supplemented rats. It is worthwhile mentioning at this time that bagoong and dilis are prepared from the same species of fish and differ only in their methods of manufacture.

The average percentage calcium retention for the milk powder, $CaCO_3$, bagoong, and dilis, are 96.8, 80.2, 60.8, and 87.2 per cent, respectively. Thus the retention of calcium from dilis is approximately 90 per cent that of milk powder while bagoong calcium was only 62 per cent retained. Even so, bagoong may serve as an important source of calcium in the diet of Filipinos.

SUMMARY AND CONCLUSIONS

1. The calcium of milk is definitely better utilized than the calcium of the other substances tested.

2. Under the conditions of these experiments, dilis is a rich source of calcium and can be considered as a good substitute for milk in the diet.

3. Bagoong fed under the same conditions is the poorest source of dietary calcium of any of the supplementary foods tried.

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SOME OUTSTANDING PROBLEMS OF THE OCEANOGRAPHY OF PHILIPPINE WATERS

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From the standpoint of oceanography, the Philippine archipelago forms a natural boundary separating the South China Sea from the Pacific Ocean. Between Formosa and the small islands farthest north of the Philippines is the Bashi Channel, which marks the only deep topographical constriction directly connecting the two large bodies of water. This passage is narrow and has a depth of over 2,500 meters in comparison to the much shallower passages contiguous to it to the south and also open to both bodies of water. The numerous straits limiting the boundaries of the Visayan Islands located on the Pacific side, and the much deeper communication between the Pacific Ocean and the Celebes Sea only indirectly link the former with the South China Sea. Waters passing through these passages have to pass through several bodies of water before they can merge with the waters of the South China Sea.

While the territorial waters of the Philippines are extensive compared to the land area, our insular shelves are narrow and steep. Those on the eastern side are generally narrower and sharper in slope than the shelves on the western side. The declivity off the eastern coast of Mindanao drops sharply into the Mindanao Trench, which is known to exceed ten kilometers in depth. Around many of our smaller islands and in a number of partially land-locked bays the shelf slopes gently outward, a feature conducive to productive fisheries.

To what extent these irregular and varied topographical features of the Philippines affect the circulation within our territorial waters remains to be studied. The current system known to modify this circulation is the North Pacific Equatorial Current. This current carries an enormous quantity of water from the western coast of America and transports it westward over long distances. Upon hitting the eastern side of the southern islands of the Philippines, it divides into two streams. That part deflected to the north, whose western edge hugs the eastern side of Luzon, generates the great Kuroshiwo Current, which is the counterpart of the Gulf Stream in the Atlantic. A part of the stream that swings to the south enters the Celebes Sea and the other part turns eastward to form the Pacific Equatorial Counter-Current.

To the north during the height of the northeast monsoon, part of the north-flowing Pacific water enters the passages between Formosa and Luzon. Once in the China Sea this water follows the direction of the winds which propel it southwestward into the South China Sea. During the period of transition in the wind system, a change in the direction of the surface current becomes increasingly apparent until during the height of the southwest monsoon season there occurs a complete reversal in the current pattern of the South China Sea. Hence, while the circulation of the water off our western coasts fluctuates with the season, that on the Pacific side appears to be permanent and independent of the changes in the prevailing winds.

The duration, direction, and intensity of the prevailing winds define the two distinct monsoons successively in operation year after year. The northeast monsoon, which is more uniform and steady, prevails for about five months from October and November through March. After a short period of transition the southwest winds begin to build up from the trades which stream out from the great tropical high pressure areas of the southern hemisphere. Owing to storms, most of which occur during this period, the southwest monsoon is more variable and intermittent in character.

The annual occurrence of these typhoons and their effects on the character of our waters present other problems in the oceanography of our seas, of which up to this time no comprehensive study has yet been undertaken. Since these storms originate from the open Pacific near the group of small islands hundreds of miles southeast of the Philippines, the turbulent waves generated by the accompanying strong winds cause a large scale agitation of the waters flushing our eastern shores. The shallow and narrow barriers in the eastern Visayan Islands serve to arrest or stall the entry of the storm waves which would otherwise create intense turbulence in our inland seas. While a stormy sea may promote mixing of the nutrient-deficient top layers with the richer water from the deeper levels, it undoubtedly disturbs fish life, which it may kill or transport to parts of the sea outside their natural habitats. The heavy rains accompanying such storms pick up plant nutrients from the land and carry them to the sea, but the rain water itself may indirectly cause an unfavorable effect in that the freshening of the surface layers of the sea tends to increase the stability of the water column. This stability of the water column is related to the enrichment of our waters and therefore of great significance in determining the productivity of our fisheries. Because of the location of the Philippines in the tropics close to the zone of maximum solar radiation, our waters are stable in character. The stable density stratification

is due to the combined effects of the excessive heating of the surface layers and the heavy rains during the southwest monsoon season when the overcast skies tend to shut out sunlight. Wind action tends to bring about homogeneity of the surface layer and as heating and mixing penetrate deeper, the cold subsurface strata immediately below this mixed layer shrink to a thinner and thinner layer within which the stratification becomes more and more firmly established. As a consequence, three distinct density zones within the entire water column become well-defined, the discontinuity layer being sandwiched between the uniform top layer above and the water column below, within which the density increases slowly with depth. The absence of an extreme cold season in the Philippines, which effects the annual overturn of water in temperate countries, perpetuates this layering which tends to mitigate the convective movements of the rich bottom waters to and within the euphotic zone.

Another problem related to the enrichment of our waters through convective processes is "upwelling". The welling up of bottom waters is a permanent feature characteristic of the rich fisheries off the western coasts of continents. A north wind blowing steadily at a sufficient speed pushes the coastal waters offshore in accordance with the Coriolis force, resulting in upwelling of the deeper waters. This process has the secondary effect of altering the distribution of mass, which results in the generation of a current parallel to the coast. Thus, the upwelled water is able to spread to a greater area along the coast. Though our coastline is extensive, it is dented by several recessions in the land and in many places is interrupted by cross-wise bodies of water. Added to these topographical characteristics of our coasts are the variability and irregularity in intensity of the prevailing winds, which together prevent the regular occurrence of upwelling in our coastal waters. Hence, for the enrichment of our waters we must look to the great water masses that flush our shores.

Another outstanding problem of Philippine oceanography is the stagnancy of bottom waters in depressions in the sea floor separated from outside waters by submarine barriers or sills. Notable among such depressions or basins in the Philippines are the Sulu Sea, Ragay Gulf and Tañon Strait. Certain characteristics of our basin waters have been fairly established by the work of the *S. F. Baird,* the research vessel used by the Philippine Fishery Program in the oceanographic surveys of our seas.

Sulu Sea, the deepest of the three basins studied, is in open communication with the South China Sea through its northern sill which is about 450 meters below the surface of the water. Since this is the deepest threshold, the characteristics of the waters of the Sulu Sea below this depth should reflect the conditions at the same depth outside this sill. The similarity in the characteristics of the water found at the same depth within and outside the Sulu Sea has been confirmed by past investigations (*Dana* and *S. F. Baird* expeditions), but the most noteworthy feature shown was the presence of oxygen in the bottom layers. The oxygen content of a given water may be taken as an index of its stagnancy, and the presence of oxygen in the great depths of the Sulu Sea, in spite of the fact that its effective sill depth may lie below the depth to which seasonal changes are no longer effective, appears to indicate that the deep waters of the Sulu Sea are renewed from time to time. The uniform character of the waters below 800 meters within the Sulu Sea points to the instability of the water column, a condition which can bring about convective circulation.

The bottom waters of Ragay Gulf and Tañon Strait, in contrast to those of the Sulu Sea, show a striking deficiency in oxygen. Due to the shallow sills, the bottom waters in these two basins have warm temperatures. High temperature accelerates the rate of organic decomposition, resulting in increased production of hydrogen sulfide. The presence of this gas interferes with the determination of oxygen content, which it tends to lower. The deficiency of oxygen in these two areas therefore can not with certitude be attributed wholly to stagnating waters but may be ascribed partly to faulty analytical procedure.

An interesting problem of oceanography that may not be of immediate practical importance but which should engage the attention of oceanographers and submarine geologists alike, is the existence of adiabatic processes in the deep waters of some of our seas. Among the regions in the Philippines where the bottom waters are observed to be heated adiabatically are the Mindanao Trench and the Sulu Sea. Very few places elsewhere are affected by the same phenomenon. Adiabatic heating is indicated by the vertical temperature distribution, which shows a significant increase in temperature with depth. At the deeper levels of the sea this rise in temperature is ascribed to the corresponding increase in pressure. If the rise in temperature exceeds that which is due to compression alone, the motionless deep waters are either invaded by warmer waters or heated from the interior of the earth.

Of the problems of topography, water circulation, seasons, convection process, stagnancy, and adiabatic heating, that of water circulation is easily the most important. An understanding of the circulation of our waters is necessary to the proper solution of many problems in fisheries science in the Philippines.

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ANATOMICAL EVIDENCE IN CASES OF FISH KILLED BY EXPLOSIVES

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Fishing by explosives has become a national problem in the Philippines after World War II due to an illicit disposal by unscrupulous persons of the war materials which were piled up in surplus depots and ammuntion dumps throughout the country. Big fishing operators still use explosives which are clandestinely obtained from surplus depots and mining companies, while others would prepare their own powder from ingredients obtainable from wholesale druggists.

One of the many duties of the Bureau of Fisheries is to find anatomical evidences in fish caught with the use of explosives so that unscrupulous fishermen may be prosecuted to the limit and thus save our fish resources for posterity. During the past two or three years the Bureau of Fisheries has been waging a systematic campaign to combat and discourage fish carriers and fishing vessels in their unlawful operations by having samples of their fish catches collected for study. One phase of the examination is by subjecting the fish sample to roentgenological examination.

Not much work has been written on this subject and not all of the few written ones are available to the writer. However, what little has been found in the literature confirms his observations. Gowanlock and McDougall (1944) found that an underwater shock wave travels at a speed of 4,940 feet per second and exerts tremendous pressure on a fish that presents a broad surface to the direction of wave travel. Studies on the effect of under-water explosives were made in connection with seismic underwater operations in California coastal waters in the exploration for oil-bearing geological formations under the sea. In this connection, Aplin (1947) found that all fish he examined which were killed with explosives had a rupture of the air bladder, which was apparently sufficient to cause death. However, most individuals also showed ruptured blood vessels, broken ribs and contents of the body cavity crushed. Fish with no air bladder showed no noticeable effect. Fitch and Young (1948) confirmed Aplin's result and found further that the ability of an underwater explosion to inflict damage decreases inversely as the cube of the distance. A fish 10 meters away from an explosion will receive approxi-

mately eight times the force from the shock waves as fish twenty meters from the explosion. A fish presenting a broadside is literally plastered up against an incompressible wall of water, and the body wall and air spaces within the fish are compressed instantaneously, allowing no opportunity for physiological adjustment to the sudden pressure.

Domantay (1939) and Maderazo (1949) found more or less the same characteristics in fish caught by explosives in the Philippines. Indrambarya (1949) found the same effect on fish killed with explosives in Siamese waters.

Medina (1949) in a preliminary study of mullet (*Mugil* sp.) killed with explosives showed to a certain extent that a displacement of the semi-circular canals and the otoliths of the internal ear takes place, as well as changes in the shapes of the chromatophores in the meninges of the brain. He is proceeding further to find out if these effects on fish are universal.

The anatomical disarrangements in the fish may be grouped into the following:

Gross aspect—

1. The air bladder, if present, is almost always ruptured and blood clots are found in its lumen.
2. The vertebral column may be fractured in any part along its length.
3. Localized hemorrhages are present around the area of fractured parts due to the destruction of the blood vessels and tearing of adjacent tissues.
4. Parts or all of the contents of the body cavity may be damaged or crushed with hemorrhages depending upon the size, shape, position and distance of the fish from the explosion.
5. Fracture and/or dislocation of the abdominal ribs from the vertebral column may be found especially in spiny fishes, with accompanying hemorrhages present in the area of the fracture.
6. The blood vessels below the vertebral column may break and cause hemorrhages of varying degrees along that region.
7. Rupture of the parietal peritoneum, especially that attached to the abdominal ribs.

Roentgenological aspect (*Figures 1 and 2*)

1. Dislocation and/or fracture of the vertebral column and ribs, if present, are clearly shown in the negative.

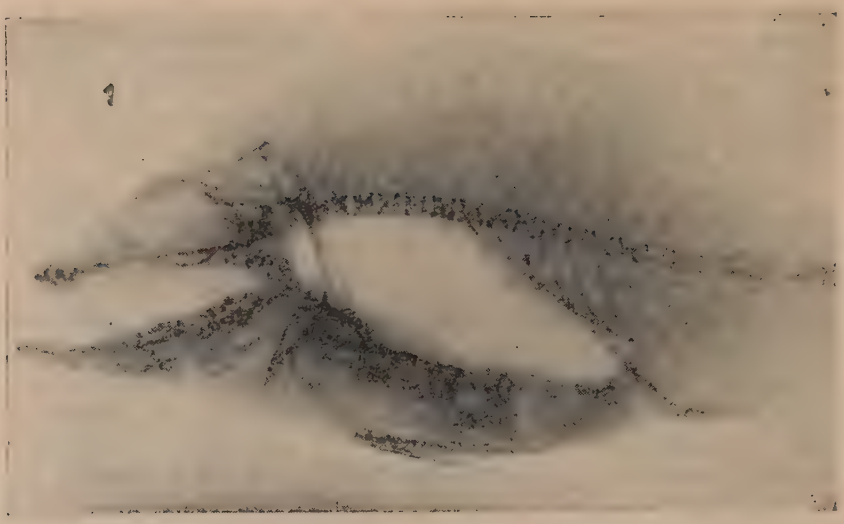

FIG. 1. X-ray picture of a normally caught maya-maya, *Lutianus* sp., showing inflated air bladder with the ribs, haemal spines and vertebral column in normal position.

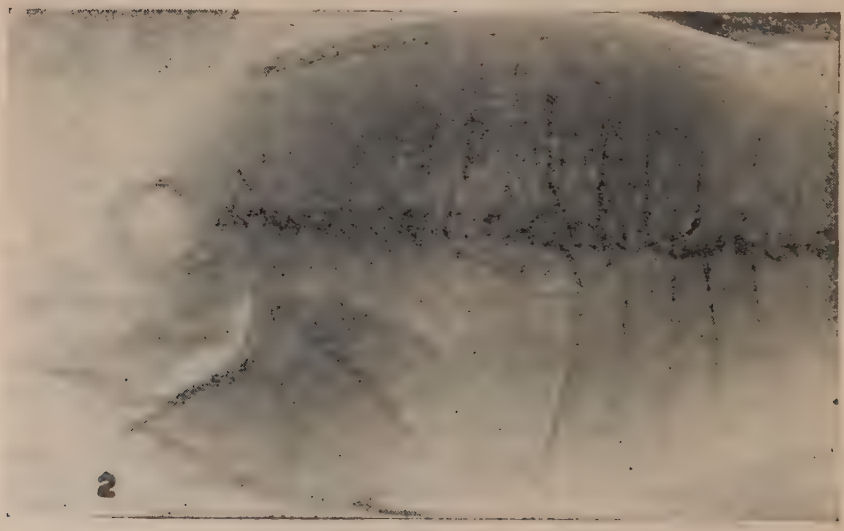

FIG. 2. X-ray picture of labahita, *Acanthurus bleekeri*, caught with explosives, with air bladder obliterated, haenal spines detached and portion of vertebral column dislocated.

2. The air bladder, if ruptured, will be filled with blood and will be obliterated in the negative. If not ruptured and, therefore, filled with air as in normal fish, it occupies a definite shape and position in the abdominal cavity. This can be seen in the negative as a black spot in the abdominal cavity of the fish.

NAMES OF FISHES COMMONLY CAUGHT BY THE USE OF EXPLOSIVES

Tagalog	*English*	*Scientific*
Agoot	Spotted	*Pomadasys hasta* (Bloch)
Alumahan	Striped mackerel	*Rastrelliger chrysozonus* (Bloch)
Asohos	Common whiting	*Sillago sihama* (Forskal)
Babansi	Grunt	*Therapon* sp.
Banak	Mullet	*Mugil* sp.
Bangos	Milkfish	*Chanos chanos* (Forskal)
Barracuda	Barracuda	*Sphyraena* sp.
Bisugo	Nemipterid	*Nemipterus* sp.
Bitilla	Porgy	*Lethrinus* sp.
Dalagang Bukid	Caesio	*Caesio* sp.
Dilis	Anchovy	*Stolephorus commersoni* (Lacepede)
Galunggong	Round scad	*Decapterus* sp.
Hasa-hasa	Short-bodied mackerel	*Rastrelliger brachysomus* (Bleeker)
Kabang	Whiskered croaker	*Sciaena* sp.
Labahita	Surgeon fish	*Acanthurus* sp.
Langaray	Glassfish	*Ambassis* sp.
Lapu-lapu	Grouper	*Epinephelus* sp.
Malakapas	Mojarra	*Gerris* sp.
Malaking Mata	Big-eyed porgy	*Monotaxis grandoculis* (Forskal)
Malaking Baka	Big-eyed scad	*Selar crumenophthalmus* (Bloch)
Maya-maya	Red snapper	*Lutianus* sp.
Oriles	Hardtail	*Megalaspis cordyla* (Linnaeus)
Salay-salay	Crevalle	*Caranx* sp.
Samaral	Siganid	*Siganus* sp.
Sapsap	Slipmouth	*Leiognathus* sp.
Talakitok	Cavalla	*Caranx*, sp.

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NEW METHODS OF FISH CAPTURE IN THE PHILIPPINES[1]

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Because fish is the cheapest source of animal protein of the Filipinos, fishing has become one of the most important industries in the Philippines. The heavy demand for fish has consequently led to the modernization of many endemic fishing devices and to the adoption of gear from other countries.

One real advantage derived by the fishing industry from the last World War is the extensive mechanization of fishing gear brought about by the large number of boats, engines and spare parts of every type of machinery left in the Philippines as surplus by the United States Army. Thus fishing bancas formerly rowed or sailed are now machine-powered and our fishermen now fish farther and land their catch quicker. The fish trap which is considered the most common method of fishing in the Philippines has also been improved from a simple pound to the complicated device set in deeper waters like the *hasang moderno*. The otter trawl and the tuna longline are two imported fishing gear that have been found to operate successfully under Philippine conditions.

THE HASANG MODERNO

The *hasang moderno* represents the latest development of fish corral in the Philippines. It consists of a series of enclosures with a leader, three entrances and wings and a leader. The multiple entrances together with the leader and wings increase the power of interception of fish by this fish corral and its series of enclosures effectively prevents the escape of the fish.

There are two types of *hasang moderno* operated in the Philippines, illustrated in *Figure 1, A and B. Figure 1A* shows the older type used in the Visayan Sea and described by Talavera and Montalban (1932). This type has three entrances, one, *m*, which is formed by the open narrow V-shaped forechamber, *fc; and* the other two, *se*, by the diverging front walls of the semicircular enclosure, *si*. A triangular compartment,

[1] Read at a symposium on Fisheries Production Problems in the Philippines under the auspices of the Fisheries Society of the Philippines on October 26, 1950.

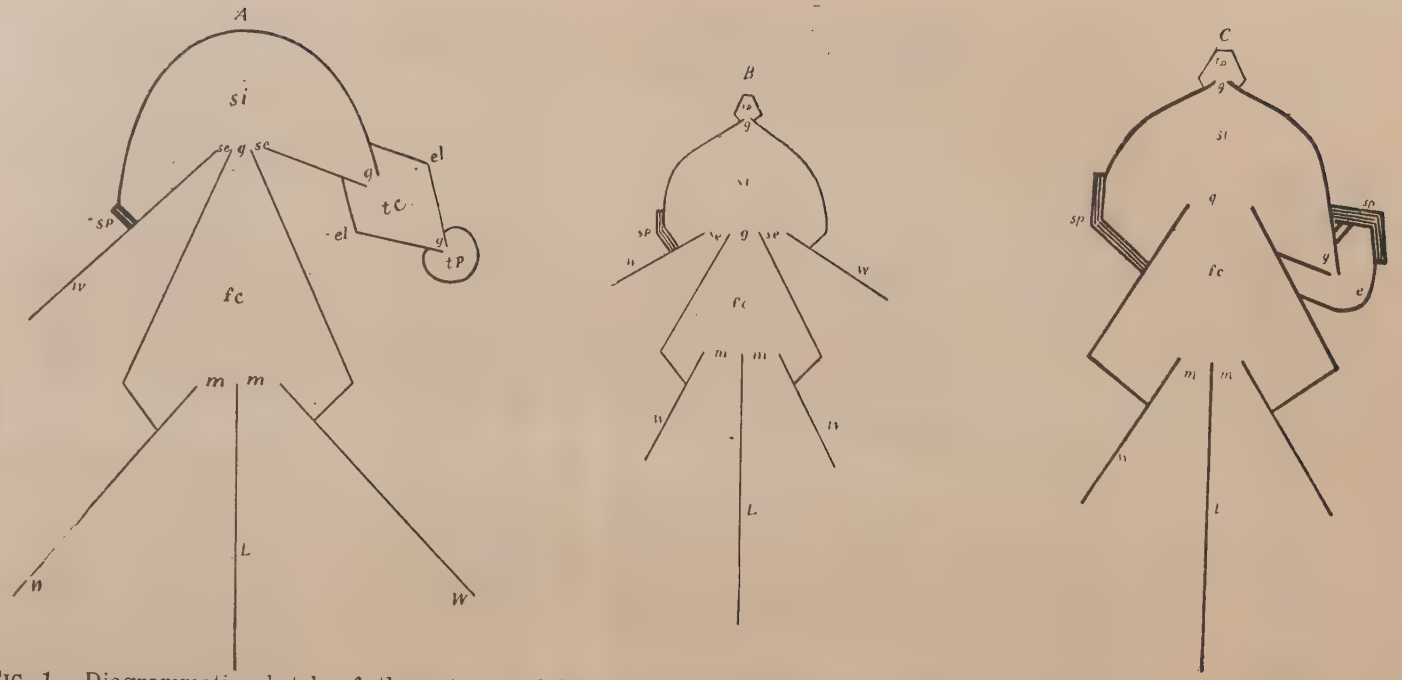


FIG. 1. Diagrammatic sketch of three types of Philippine fish corrals. A—*hasang moderno*, Kalibo type; B—*hasang moderno*, Visayan Sea type; C—ordinary type, or *balonan*.

tc, is constructed on one end of the semicircular enclosure and leads to the terminal pound, *tp*.

The new type of *hasang moderno*, *Figure 1B*, has been developed in Kalibo, Capiz, last summer. It has three entrances like the old type *hasang moderno* but the terminal pound is constructed on the same axis with the leader, *L*, the forechamber, *fc*, and the semicircular enclosure, *si*.

On the basis of the new type of *hasang moderno*, constructed at Kalibo, Capiz, the actual cost to erect this type of fish corral is ₱3,737.00, itemized as follows:—

1. *Equiment*:

One banca, 14 m × 1 m	₱ 250.00	
One banca, 3.84 m × 7 m	50.00	
One ring net (*sigin*), 26.82 m headrope × 12.19 m deep × 22.55 m round rope, complete with floats, weights, pursing device and pull ropes	1,405.00	
One shrimp net (sinamay cloth, 7.74 m × 3.43 m × 8.45 m complete with rings and pull ropes	50.00	
One scoop net	5.00	
Eight oars	20.00	
Total for equipment		₱1,780.00

2. *Supplies*:

1,187 pcs. bamboo (without spines) each about 10 meters long	842.00	
350 pcs. bamboo (with spines), each about 10 meters long	350.00	
2,050 pcs. rattan, split, each about 12 feet long	58.00	
15,000 pcs. inflorescent bud scales (coconut)	195.00	
1 roll of Manila rope 1/2 inch diameter	67.00	
Total for supplies		1,512.00

3. *Labor*:

For splitting bamboos	₱ 45.00	

For weaving split bamboos into mattings or screens	350.00	
For erecting the fish corral	50.00	
Total for labor		445.00
GRAND TOTAL		₱3,737.00

The following table shows the comparative volume of catch of the *hasang moderno* and the ordinary fish corral, called *balonan* (*Figure 1C*), both constructed in Kalibo, Capiz in 6 to 8 fathoms deep. The two fish corrals were set about 200 meters apart and operated from April 1, 1950, to October 15, 1950, by one person.

Months	Hasang Moderno		Balonan	
1950	Amount of fish caught	Value	Amount of fish caught	Value
	Kilo		*Kilo*	
April	2,649.00	₱ 2,560.20	1,506.75	₱ 1,654.26
May	5,170.75	3,146.82	1,043.00	942.26
June	5,107.00	1,350.26	1,006.00	832.31
July	1,747.50	769.31	217.50	182.50
August	560.80	537.70	360.00	289.47
September	1,033.00	815.36	342.25	322.91
October 1-15	960.00	895.47	786.60	777.69
TOTAL	17,228.05	₱10,075.12	5,262.10	₱ 5,001.40

Although the figures are obviously inadequate, they at least show in a rough way the effectiveness of the *hasang moderno*, Kalibo type, in comparison with the other types of fish corrals, a fact which is generally accepted by fishermen in Kalibo.

An appreciable increase in the catch of *hasang moderno* is noted when an incandescent lamp is placed in the semicircular enclosure to attract fish during the dark phase of the moon.

THE OTTER TRAWL

The otter trawl was first introduced into the Philippines about 1909 by an Englishman. The gear was found effective for catching the little touched bottom species but because the boat used was a steam dragger, the cost of operation was high and the business had to be stopped after six months as a los-

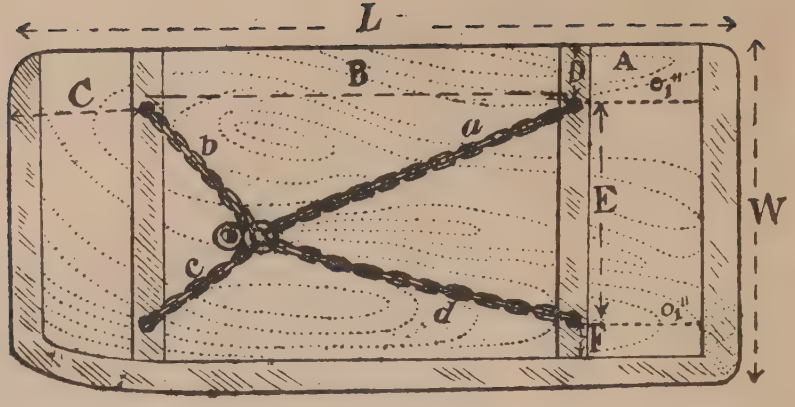
ing proposition. The Bureau of Fisheries made several otter trawl fishing experiments in 1939, using a small trawler. This experimental fishing was resumed after the War in 1946 by the Bureau and with a 65-foot boat was able to demonstrate fully the effectiveness of the gear in the waters between Catbalogan and Calbayog, Samar. The U.S. Fish and Wildlife Service also contributed to the popularization and wide use of the otter trawl so that at present there are over a hundred otter trawlers operating in Philippine waters.

The net is in the form of a conical bag with two wings, and tapers down from a wide mouth to a small bag or cod end. It is dragged along the sea bed from a towing vessel by means of two long warps. The net is held open by two otter boards which is dragged along the sea bed on their runners like a paravane stretching the wings and mouth of the net between them. The open mouth of the net is bounded on its lateral sides by the two wings, above by a headrope to which are attached a number of floats, and below by a footrope. The floats on the headrope together with the friction of the water passing through the meshes make the roof of the mouth of the net curve upward while the footrope, weighted down by lead, stones or chains, keeps the bottom or floor of the net in contact with the sea bottom. Fish which happen to be in the path of the net are swept through the open mouth and impounded at the bag.

Various adjustments are made to improve the effectiveness of the gear under varying conditions of the dragging grounds, trawlable species, etc. Among such adjustments are: (1) making the headrope at least 10% shorter than the footrope; (2) making proper adjustments on the otter doors to attain the widest possible opening of the mouth of the net; and (3) dragging at a speed of at least two knots.

If the headrope is shorter than the footrope, the former advances through the water ahead of the latter. Thus when a bottom fish on the path of the net is disturbed by the approach of the footrope, its immediate response is to dash upward and strike the bating or top belly which is already over it. If the fish darts to either side, it strikes the wings and if it swims ahead, it will remain on the path of the net with a more than even chance of being caught.

It often happens that because of wrong adjustment in the otter doors, the mouth of the net does not open properly. For a successful operation, the otter doors are constructed to achieve the proper balance and their chain bridles adjusted in such a way that they sweep outward and do not dig deep on the ground. Figure 2 shows an otter door and the formula



	Per cent		Per cent		Per cent
W/L	*45.0*	*D/W*	*14.8*	*a/L*	*54.0*
A/L	*23.0*	*E/W*	*74.0*	*b/L*	*33.0*
B/L	*48.0*	*F/W*	*11.1*	*c/L*	*29.0*
C/L	*26.6*			*d/L*	*51.0*

FIG. 2. The otter door, with proper adjustment ratios for light and medium types.

for computing the distances between the different parts of the otter door and the different lengths of each chain bridle.

Of late, several experiments have been done to make the otter trawl more efficient and the net to last longer, among which are the following:—

1. The use of dynamometer to determine the amount of fish present in the net during dragging.
2. The use of rollers on the footrope so that the net could be dragged along stony bottoms.
3. The use of treated hide to protect the cod end from tear.
4. The use of the "pareja" net to catch pelagic species especially sardines.

TUNA LONGLINE

Tuna longline fishing was introduced in the Philippines by Japanese fishermen, but the Filipinos did not show interest in it until its reintroduction this year. The gear is a longline used for catching yellow-fin tuna and other big fish found in the sub-surface layers of the sea. It consists of several miles of stout line with floats, flags and hooks, divided into units or baskets of about 240 fathoms each (*Figure 3*), and set from a boat especially designed for the purpose.

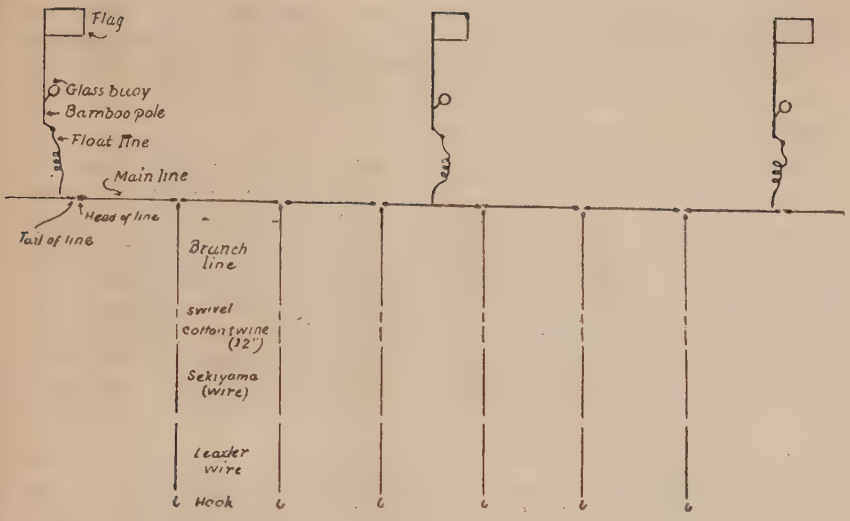


FIG. 3. Diagram of a tuna longline set.

A typical tuna longline fishing boat is about 65 feet long, 18 feet wide and 8 feet in draft. The fore- and aft-deck is set moderately low to facilitate the shooting of the lines from the stern and hauling them on the foredeck. A line hauler is placed on the starboard side of the maindeck forward of the pilot house. The hatches are on the maindeck close to the line hauler.

The main power plant is a heavy duty Diesel engine of about 85 horsepower. The auxiliary engine which turns the roller is directly connected to the main engine by means of a power take-off. A generator supplies light on board.

The gear is operated by fourteen to sixteen men. They are compensated on a profit-sharing basis but the officers and the master fisherman receive base pay besides.

The success of the tuna longline fishing depends upon the ability of the master fisherman to locate a rich fishing ground (Shapiro, 1950). Such ability is possible in a large measure to a comprehensive knowledge of oceanographic conditions since it has been amply shown that the yellow-fin tuna and other big-sized fish are greatly influenced by definite factors in the

sea such as temperature, salinity, currents, etc. The longline outfit is usually set across the path of migration of the fish or near an obstacle in their path which may be an island, a reef, a submerged bank or a difference in water temperatures between two water masses.

When the fishing ground is determined, preparation is made for the shooting of the net. The baskets containing the longline are arranged at the stern together with the floats, flag poles and baits. The coils of lines in each basket are so arranged that the beginning of the main line and the first float line are on top. This is followed by the other portion of the mainline and the branch lines containing the leaders and hooks; then another coil of the mainline, a branch line and so on up to the end of the mainline. Arranged this way, the longline is ready for shooting.

A flagpole stand and a buoy are tied to the head of the floatline. A piece of iron is secured to the floatline to keep the flagpole standing in the water. These are cast overboard as the boat moves forward. Meanwhile, the bait handler picks up the branch line from the basket, ties it to the mainline and puts the bait on the hook and then throws this part of the gear overboard. This operation is continued until all the lines in the baskets are laid out.

After setting the gear, the boat turns around and goes back to the starting point and starts to patrol. A strike is easily determined by the sinking of the nearest flagpole. At night, lights are used instead of flagpoles. These lights indicate the whereabouts of the longline and warn other longline operators of the presence of the gear in the sea. The catch is taken as quickly as possible as big fish especially sharks often attack the fish caught.

The gear is hauled from the starboard where the longline hauler is installed. To prevent the line from getting entangled with the propeller, the boat always moves toward the gear being hauled in. As the main line comes aboard, it passes over the roller on the deck rail and is fed to the line hauler. The speed of the boat during hauling is usually about three knots depending upon the current of the water, number of fish caught, difficulties in hauling fish aboard, and the speed of the longline hauler. The mainline is placed on a wooden platform below the wheels while the branches are detached and coiled in the baskets as they come in.

The catches of a tuna longline in Philippine waters are mostly yellow-fin tuna, and some sailfish, swordfish, marlin, and sharks. The fish caught usually ranges from 30 kilos to as much as 400 kilos in weight.

The following is an estimated cost of a tuna longline fishing outfit:

One hull, new, 65' x 18' x 8', clear stern complete with mast, boom, cabin and air-tight storage hold of 20-30 tons capacity ...	₱14,500.00	₱14,500.00
One Diesel engine, 120 H.P. heavy duty, complete with accessories	29,000.00	
One Diesel engine, 115 H.P. heavy duty (Japanese Type) complete with propeller and accessories (alternate)		15,000.00
Refrigeration units installed in the storage hold. (alternate)	10,000.00	
(Not necessary if the catch is preserved by direct icing):		
Navigational instruments	2,000.00	2,000.00
Life raft, life belt, etc.	400.00	400.00
One longline hauler	2,000.00	2,000.00
50 baskets longline at ₱100 per basket	5,000.00	5,000.00
Total	₱62,900.00	₱38,900.00

The operating cost of a tuna longline vessel for a one-month trip is estimated as follows:

3,000 pcs. of bait at ₱0.20	₱ 600.00
30 drums of fuel oil	400.00
60 gals. of lub. oil	150.00
4,000 lbs. of crushed ice	400.00
Subsistence of the crew at ₱12.00 a day for 30 days	360.00
Miscellaneous	300.00
TOTAL	₱ 2,210.00

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THE DAGAT-DAGATAN SALT-WATER FISHERY EXPERIMENTAL STATION

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The Dagatdagatan Salt-Water Fishery Experimental Station of the Philippine Bureau of Fisheries was established in 1937. It is located about ten kilometers north of the City of Manila in Dagatdagatan Lagoon within the jurisdiction of the municipalities of Navotas, Caloocan, and Malabon, Rizal province. These municipalities, notably Malabon, have the greatest concentration of fishponds and other fisheries industries in the Philippines.

OBJECTIVES AND FUNCTIONS

The station was originally designed for research to improve the culture of *bañgos* (*Chanos chanos* Forskal) which is an old and highly developed industry in the Philippines. Lately, however, its functions have been expanded to include instruction and extension services.

Researches on the culture of *bañgos* are directed toward increasing the productivity of fishponds through improved fish cultural techniques. The experimental cultivation of other aquatic animals along with *bañgos* is also being undertaken for commercial possibilities and thereby further increase the productivity of *bañgos* fishponds.

The practical training of students taking fish culture courses in the Philippine Institute of Fisheries Technology of the Bureau of Fisheries is mostly given at the Dagatdagatan station. Actual and prospective fishpond owners and caretakers are given free demonstrations on the proper methods of fish cultivation at this station. Lectures and demonstrations on fishpond operations are given to visiting students from other schools and colleges.

The station personnel go out from time to time in answer to requests from different fish culture establishments for assistance in selecting fishpond sites, in the preparation of fishpond layouts, and in actual construction of new fishponds.

PERSONNEL AND FACILITIES

The Dagatdagatan station started with a staff of one technical man, a watchman and one to three emergency maintenance workers. When the station was ready for experimental work, the staff was reinforced by more technical men and laborers. Further assistance in research was provided by fisheries and biology students from the University of the Philippines. This condition existed up to the outbreak of World War II.

During the Japanese Occupation technical men were also assigned to the station, but the difficulties of the time made the staff more or less temporary and changes were frequent.

The years after the war were marked by a rapid expansion of the station. The former Division of Fisheries which operated this station was enlarged to a full-fledged Bureau of Fisheries and the appropriation for the station was correspondingly increased. Through the generous financial assistance extended by the U. S. Fish and Wildlife Service under the Philippine Rehabilitation Act, the station was quickly rehabilitated. Today, the station is considered one of the best-equipped for fisheries research in this part of the world. The staff has been increased to a total of nine technical men and nine maintenance personnel.

The following are the facilities and equipment of the Station for fisheries research:

1. Eleven rearing ponds (*kaluangan*), eight nursery ponds (*pabiayan*), and two transition ponds (*impitan*), all with a system of water supply canals.
2. Six experimental ponds each 10 meters by 5 meters and ten concrete tanks, 1.5 meters square, with both fresh and brackish water connections.
3. A small laboratory and office building, a storehouse for supplies and equipment, and a small experimental smokehouse.
4. A small generator for lighting and power and a water pump for brackish water.
5. Meteorological and hydrographic equipment including an anemometer, rain gauge, thermometer, pH comparator, salinometer set, tide gauge, Secchi discs and water depth gauges.
6. Seven bancas, one small motor launch, and one outboard motor.
7. Miscellaneous laboratory equipment including compound microscopes, dissecting microscopes, centrifuges, balances, plankton nets, glass aquaria, various containers and preservatives.

DEVELOPMENT PLAN OF THE STATION

From 1937 to the present the station has made considerable progress in the pursuit of the objectives for which it was established. Even during the reconstruction and rehabilitation of the station after the war, researches were kept in progress as best as circumstances permitted. Problems dealing with the cultivation of *lumut*, the algal food of bañgos, are being investigated. Studies on the composition of *lab-lab*, the natural food of bañgos fry and fingerlings under cultivation, and the biology of commercial crustacians such as *sugpo* (*Penaeus monodon*), and *alimango* (*Scylla serrata*) have been made.

In addition to the above researches, the technical personnel are at present engaged in the following projects: fertilization of fishponds, nutrition and rate of growth of bañgos under cultivation, artificial feed, fish diseases, parasites and enemies in ponds, studies on pond survey, layout and construction and designs of gates, pipes and dikes.

The present plan of the Bureau of Fisheries is to further expand the facilities of the Dagatdagatan station and develop it as the fisheries research center of the Philippines. It is contemplated to concentrate in this station all fundamental work on fisheries biology and technology. To implement this plan two large concrete buildings are now nearing completion and will house the biological and technological laboratories and the pilot fish canning plant of the Bureau of Fisheries.

ALPHABETICAL LIST OF CHARTER MEMBERS OF THE FISHERIES SOCIETY OF THE PHILIPPINES

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MANALO, AUGUSTO D, 3 Mercedes, San Pedro Makati, Rizal. FISHERIES PRODUCTS TECHNOLOGY. Pateros, Rizal, Phil, June 20, 19; md. 49, ch. 1. B.S. (fisheries) Univ. Phil, 40; grad. sch. Oregon State Coll, 48. Technical demonstrator, div. fisheries, dept. agric. and comm, 40-42; fish. inspector, div. fisheries, 43-44; asst. aquatic biol, 44, jr. ichthyologist, 45-46; fishery trainee, U.S. Fish and Wildlife Service, 47-48; asst. fish. technologist, bur. fisheries, 46-49; FISHERY TECHNOLOGIST, BUR. FISHERIES, 49—. Fish. Soc. Phil.

MARTIN, CLARO, San Francisco del Monte, Quezon City. FISHERIES TECHNOLOGY. Malolos, Bulacan, Phil, Aug. 10, 03; md. 29, ch. 6. B.S. (zoology) Univ. Phil, 27; Univ. Calif, 31. Assistant, 27-28, asst. ichthyologist, 28-34, div. fisheries, bur. science; Phil. gov't. pensionado, U.S, 31; in-charge, Manila Aquarium, 34-36; jr. scientist, 36, district fish. officer, 36-37, asst. fish. technologist, 37-39, fish and game adm, bur. science; in-charge, fish preservation station, Estancia, Iloilo, 37-42 (dist. fish. off, 37-41), asst. inchthyologist, 39-40, fish and game adm, bur. science; fishery technologist, div. fisheries, dept. agric. and comm, 40-43; asst. scientist, div. zoology, bur. science, 43; supervising fishery inspector, fish culture fed. Phil, 43-44; fish. technologist, div. fisheries, dept. agric. and comm, 45-47; zoologist, bur. fisheries, 47; CHIEF, DIVISION OF FISHERIES TECHNOLOGY, BUR. FISHERIES, 47—. Adv. on fish, Phil. deleg, FAO fish. conf, Baguio, 48; chief Phil. del, sub-area comm. meeting, FAO, Buitenzorg, 48 and inaug. meeting, Indo-Pacific Fish. Coun, Singapore, 49; alt. del, Indo-Pacific Fish. Coun. meeting, Cronulla, 50; Phil. Sc. Soc; Nat. Research Coun; Phil. Nat. Comm. FAO; Fish. Soc. Phil; Assoc. ed, Bulletin, Fish. Soc. Phil.

MONTALBAN, HERACLIO R, Barrio Longos, Malabon, Rizal. FISH CULTURE, FISH PRESERVATION, FISHING METHODS, ICHTHYOLOGY. Iloilo City, Phil, Oct. 22, 95; md. 22, ch. 5. B. A. Zool. (Ichthyol.) 21, M.A, 23, Stanford University; Grad. sch. (fisheries) Univ. Washington, 23-24. Instr. bur. education, Phil, 21-22; assistant, div. fisheries, bur. science, 22-25; Phil. gov't. pensionado, U.S, 22-24; ichthylogist, 25-27, asst. chief, 27-33, assistant, 33,

div. fisheries, bur. science; scientist, 33-37, tech. asst, 37-39, fish and game adm, bur. science; tech. asst, 39-40, aquatic biologist, 40-42, div. fisheries, dept. agric. and comm; chief, div. fisheries, bur. forestry and fishery, 42-44; assoc. reesarcher, nat. research center, 44-45; member, rehabilitation planning committee, 45; aquatic biologist, div. fisheries, dept. agric. and comm, 45-47; CHIEF, DIV. FISH CULTURE AND FISHERIES BIOLOGY, BUR. FISHERIES, 47—. Contrib. ed. Phil. Journ. Sc; Phil. del, first Pan-Pacific Food Conserv. Conf. Honolulu, 24; Sigma Xi (Stanford); Phil. Sc. Soc; Nat. Research Coun; Fish. Soc. Phil.

MONTILLA, JOSE R, Bur. Fisheries, Manila. COMMERCIAL FISHERIES, AQUARIUM MANAGEMENT. San Fernando, La Union, Phil, Aug. 7, 96; md. 27, ch. 3. B.S. (fisheries) Univ. Washington, 25. Asst. itchthyologist, div. fisheries, bur. science, 26-27; asst. scientist, 27-31; ichthyologist, 31-37, zoologist, 37-42, div. fisheries, dept. agric. and comm; fishery technologist, bur. forestry, 42; chief, div. technol. and aquarium management, bur. fisheries, 44; asst. chief, procurement div, ECA, 45; zoologist, div. fisheries, dept. agric. and comm, 45-47; CHIEF, DIV. COMMERCIAL FISHERIES, BUR. FISHERIES, 47—. Nat. Research Coun; Fish. Soc. Phil.

RABANAL, HERMINIO R, Bureau of Fisheries, Manila. FISH CULTURE, FISHERIES BIOLOGY. Alaminos, Pangasinan, Phil, Sept. 20, 17; md. 48. B.S. (fishery) Univ. Phil, 40: M.A. (biology) Harvard, 48. Lab. helper, nat. reesarch coun, 37-38; stu. asst, dept. zool, Univ. Phil, 39-40; scientific aide, nat. hist. museum, dept. agric. and comm, 40-41; fish culturist, bur. fisheries, 43-44: junior scientist, nat. hist. museum, 45-46; fish. technologist, bur. fisheries, 46-47; fish. trainee, U.S. Fish and Wildlife Serv, 47-48; chief of section (fish culturist) PIFT, bur. fisheries. 48-49; FISH CULTURIST, BUR. FISHERIES. 49. Am. Ass. Adv. Sc: Am. Soc. Limn. and Oceanogr; Am. Fish. Soc; Soil Sc. Soc. Phil; Fish. Soc. Phil.

RASALAN, SANTOS B. 1175 Kundiman, Sampaloc, Manila. FISHERIES GEAR TECHNOLOGY, FISHERIES BIOLOGY. Sarrat, Ilocos Norte, Phil, Nov. 1, 05; md. 33, ch. 5. A.A., Univ. Phil, 29, B.S. (zoology), 30. Stud. asst, fish and game adm, 34-35; tech. demonstr. 35-38, jun. ichthyol, 38-42, div. fisheries, bur. science; dist. fish. off, div. fisheries, 35-46; asst. fish culturist, bur. forestry and fisheries, 42-43; fish technologist, bur. fisheries, 43-46; asst. ichthyol, div. fisheries, 46-47; ichthyologist, 47-48, chief of section (fishery technologist) 48-49, bur. fisheries; chief, fish capture sec, PIFT, 47—; FISHERY BIOLOGIST, BUR. FISHERIES, 49—. Am. Fish Soc; Fish. Soc. Phil.

SANCHEZ, JOSE G, Caloocan, Rizal. FISHERIES LEGISLATION. Pasig, Rizal, Phil, Jan. 1, 06; md. 32, ch. 4. LL.B, Univ. Phil, 30. Land atty, 37-39, atty, 39-40, dept. agric. and comm; chief inspector, div. fisheries, 40-42; comm. agent, bur. comm. and ind, 42-43; prov.

superv, food adm .office, 43-45; chief inspector, div. fisheries, 45-47; CHIEF, DIV. LICENSES AND REGULATIONS, BUR. FISHERIES, 47—. Phil. Bar Ass; Fish. Soc. Phil.

SEBASTIAN, ALFONSO R, 930 Misericordia, Manila. OCEANOGRAPHY, METEOROLOGY. Hagonoy, Bulacan, Phil, Feb. 8, 17; md. 46, ch. 3. B.S. (geodetic engineering) Univ. Phil, 46; Grad. Sch. (oceanography) Univ. Washington, 49. Appr. surv, bur. lands, 37-41; obs. comp. meteorol, seismic and magnetic divs, weather bu, 43-44; officer-in-charge, Antipolo magnetic observatory, 43; asst. geod. engr, bur. fisheries, 46-49; oceanographer (co-operator) U.S. Fish and Wildlife Service, 49; fish. trainee, U.S. Fish and Wildlife Serv, 49; instr, Phil. Institute Fish. Technology, 46—; CHIEF OF SECTION (FISHERY TECHNOLOGIST) PIFT, BUR. FISHERIES, 49—. Fish. Soc. Phil; Assoc. ed, Bulletin, Fish. Soc. Phil.

SULIT, JOSE I, 77 del Pan, Makati Rizal. CHEMISTRY, FISHERIES PRODUCTS TECHNOLOGY. Bauan, Batangas, Phil, July 3, 07; md. 34, 49, ch. 5. B.S. (Pharm. Chem.) Wash. State Coll, 32, M.S. (Pharm Chem.) Univ. Phil, 34. Chemist, food technoolgist, bur. plant industry, 35-46; asst. ichthyologist, bur. fisheries, 47-49; CHEMIST, BUR. FISHERIES, 49—. Am. Pharm. Ass; Phil. Pharm. Ass; Chem. Soc. Phil; Phil. Ass. Nutr; Fish. Soc. Phil.

UYENCO, VIRGILIO A, 1445 O'Donnell, Manila. CHEMISTRY, FISHERIES PRODUCTS TECHNOLOGY. Bacolor, Pampanga, Phil, Oct. 10, 16; md. 50. B.S. (Chem.) Univ. Phil, 39, Grad. Sch. Univ. Wash, 47, M.I.T., 47 Res. fell. pharmacol, Univ. Phil, 39-42; chem. instr. 42-43; chemist, inst. of hygiene, Univ. Phil, 46; asst. chem. bur. fisheries, 46-47; fish. trainee, U.S. Fish & Wildlife Serv, 47-48; CHIEF OF SECTION (CHEMIST) PIFT, BUR. FISHERIES, 48—. Fish. Soc. Phil.

VERA, ANTONIO, M. DE, 3 Ligaya, Sta. Mesa, Manila. FISH PRESERVATION. Aguilar, Pangasinan, Phil, Sept. 10, 10; md. 43, ch. 3. A.I.E, Adamson Univ, 37; Imper. Fisheries Inst, Tokyo, 40; B.S.E, Adamson Univ, 50. Asst. instr. (chem.) 37, head prof. dept. ind. chem, 40, dept. food tech, 41, Adamson Univ; head, dept. pract. ind. chem. Cebu City voc. sch, 41; fish. technoolgist, bur. fisheries, 44; asst. ichthyologist, div. fisheries, 46-47; ichthyologist, bur. fisheries, 47-48; registrar, PIFT, 46-47; CHIEF OF SECTION (FISHERY TECHNOLOGIST), PIFT, BUR. FISHERIES, 48—. Phil. Soc. Ind. Eng; Imp. Fish. Soc. Japan; Fish. Soc. Phil.

VILLADOLID, DEOGRACIAS V, 590 Figueroa, Paco, Manila. ICHTHYOLOGY, FISHERIES BIOLOGY. Nasugbu, Batangas, Phil, March 22, 96; md. 21, ch. 4. B. Agr, 19, B.S.A, 22, M.S, 23, Univ. Phil; Ph. D. (zoology) Stanford, 27; Student laborer, 13-15; stud. asst (bot, chem, zool, and entomol) Univ. Phil, 15-19; regt'l. sgt. major, Phil. Nat. Guard, 18; asst. chem, instr. in zool. and entomol, coll. agric,

19-24; fellow, Univ. Phil. to Stanford Univ, 24-27; asst. prof, zool, Univ. Phil. 28-34; tech. asst, then aquatic biologist, fish and game adm, dept. agric. and commn, 34-40; chief, div. fisheries, 40-41, director of fisheries, 44; chief, div. fisheries, 45-47; DIRECTOR OF FISHERIES, DEPT. AGRIC. AND NAT. RESOURCES, 47—Assoc. ed, Phil. Journ. Sc; contrib. ed, Phil. Life News Mag; Phil delegate Sixth Pacific Sc. Cong. 39; chairman, fisheries panel, FAO United Nations conf, Baguio, 48; Phil. del FAO UN meetings, Wash. D.C, 48-49; Chief Phil. del, Indo-Pacific Fish. Coun. meeting, Cronulla, Australia, 50; Vice-chairman, IPFC, 50-51; Nat. Res. Coun; Am. Ass. Adv. Sc; Am. Fish. Soc; Sigma Xi (Stanford); Am. Soc. Ichthyol. and Herpet; Soc. Adv. Research; Nat. Geog. Soc; Board of Nutrition, Phil; Phil. Sc. Soc; Fish. Soc. Phil; Ed-in-chief, Bulletin, Fish. Soc. Phil.

VILLALUZ, DOMICIANO K, Bur. Fisheries, Manila. FISH CULTURE, FISHERIES BIOLOGY. Angono, Rizal, Phil, July 30, 09; md, ch. 5. B.S.E. (biol.), 31, M.S. (zoology), 37, Univ. Phil; Imp. Fisheries Inst, Tokyo, 41; Grad. sch. (fisheries) Univ. Washington, 47; Grad. asst, (zool) Univ. Phil, 31-36; instr (zool. and bot.) San Beda Coll, 31-36; tech. demonstr. bur. science, 37-38; fish and game warden, dept. agric. and comm, 38-40; jr. ichthyologist, div. fisheries, 40-45; fish culturist, 45 48, asst. ichthyol, 48, bur. fisheries; in-charge, Binakayan Oyster farm, 37-41; U.S. State Dept. Scholar, Univ. Washington, 46-47; ZOOLOGIST, BUR. FISHERIES, 48—. Phil. alt. del, Indo-Pacific Fish. Coun. meeting, Cronulla, 50; Nat. Research Coun; Phil. Agron. Soc; Sigma Xi (Univ. Washington); Fish. Soc. Japan; Fish. Soc. Phil; Asso. ed, Bulletin, Fish. Soc. Phil.

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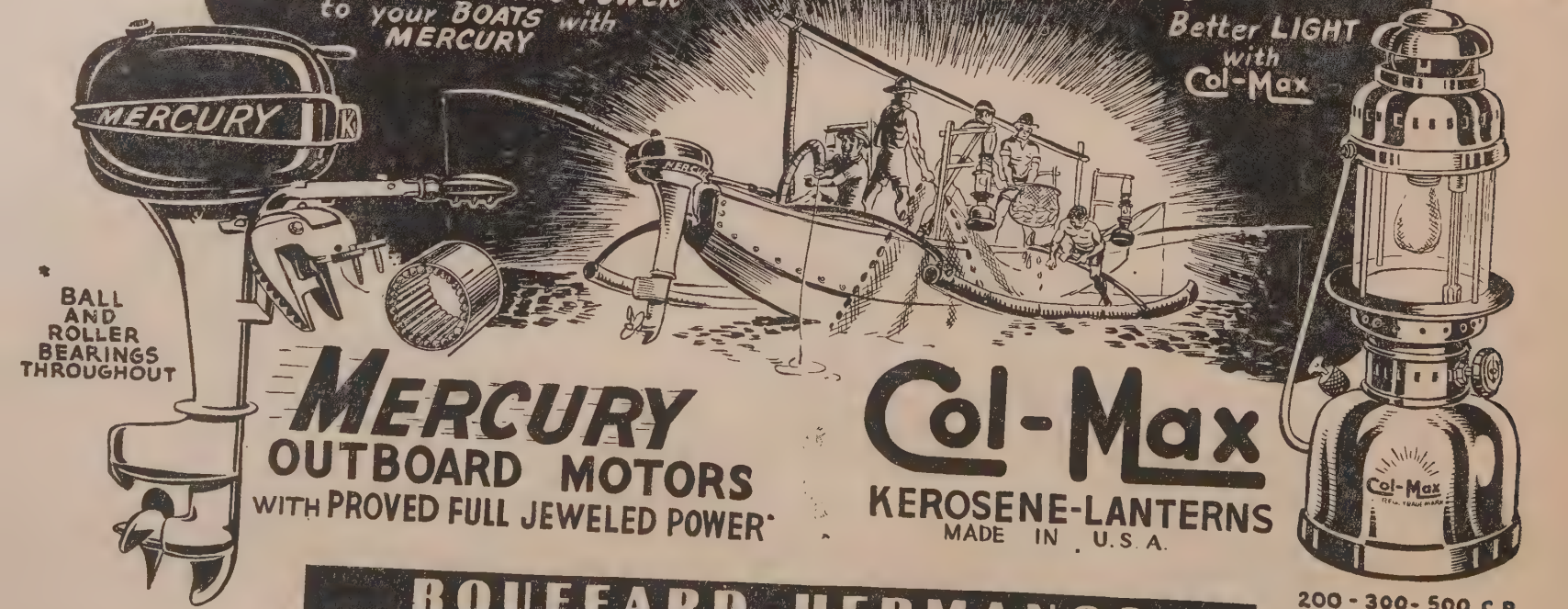

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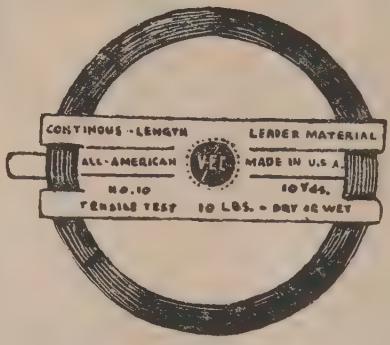

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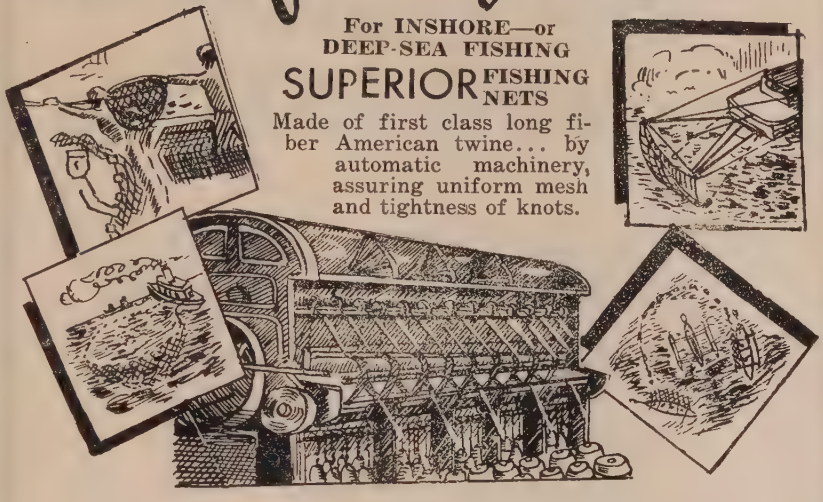

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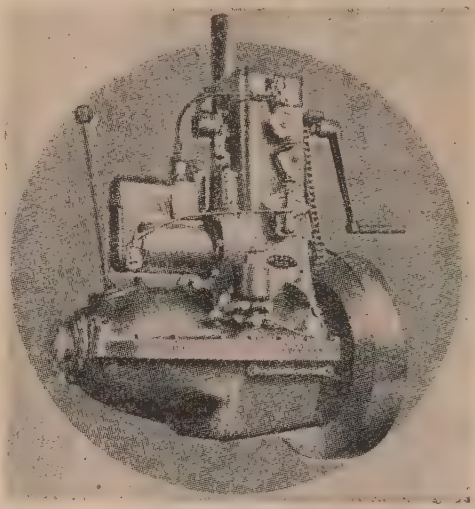

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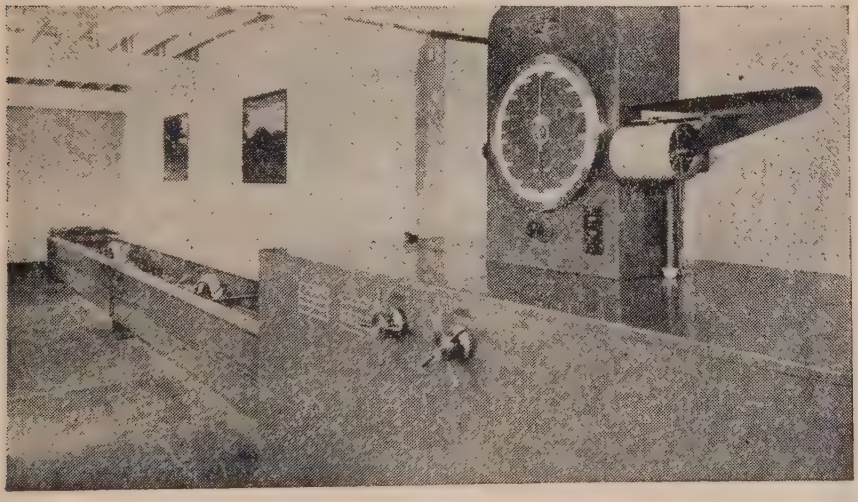

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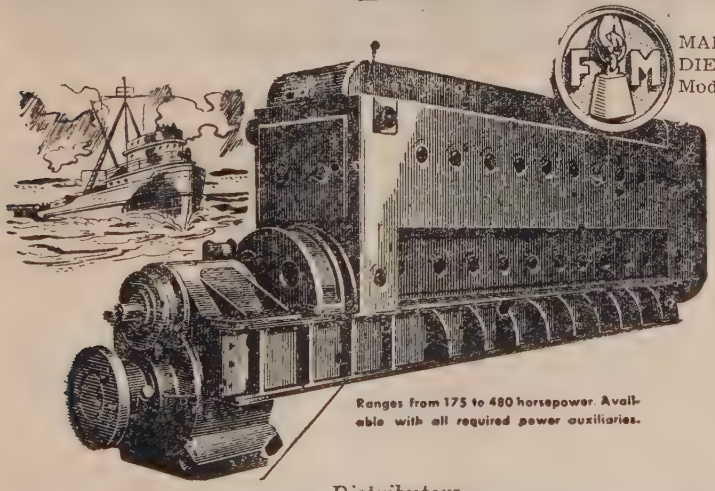

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